A STUDY OF INTRADIALYTIC COMPLICATIONS IN PATIENTS UNDERGOING HEMODIALYSIS

A DISSERTATION SUBMITTED TO

THE TAMIL NADU DR. M.G.R MEDICAL UNIVERSITY

CHENNAI, TAMIL NADU

BY

Dr. PRIYADHARSHINI.S.,

IN PARTIAL FULFILMENT OF THE REQUIREMENTS

FOR THE AWARD OF THE DEGREE OF

DOCTOR OF MEDICINE - BRANCH I

(GENERAL MEDICINE)

TIRUNELVELI MEDICAL COLLEGE HOSPITAL

TIRUNELVELI – 11, TAMIL NADU

MAY 2019

BONAFIDE CERTIFICATE

This is to certify that this dissertation entitled "**A STUDY OF INTRADIALYTIC COMPLICATIONS IN PATIENTS UNDERGOING HEMODIALYSIS**" submitted by **Dr. PRIYADHARSHINI.S.,** to The Tamilnadu Dr. M.G.R Medical University, Chennai, in partial fulfilment for the award of M.D Degree (GENERAL MEDICINE) is a bonafide work carried out by her under my guidance and supervision during the course of studyfrom **2015** to **2019**.

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DECLARATION

I solemnly declare that the dissertation titled **"A STUDY OF INTRADIALYTIC COMPLICATIONS IN PATIENTS UNDERGOING HEMODIALYSIS"**is prepared by me under guidance of **Prof.Dr. L. RAJAGOPALA MARTHANDAM, M.D**. The dissertation is submitted to The TamilnaduDr. M.G.R Medical University towards partial fulfilment of requirements for the award of M.D Degree (Branch I) in General Medicine. I also declare that this bonafide work or a part of this work was not submitted by me or others for any award, degree, diploma to any university, found either in India or abroad.

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CERTIFICATE OF REGISTRATION & APPROVAL OF THE TIREC REF NO: 964/GM/2017

PROTOCOL TITLE: A STUDY OF INTRADIALYTIC COMPLICATIONS IN PATIENTS UNDERGOING HEMODIALYSIS

PRINCIPAL INVESTIGATOR: Dr.PRIYADHARSHINI.S., MBBS.,

DESIGNATION OF PRINCIPAL INVESTIGATOR: PG STUDENT

DEPARTMENT & INSTITUTION: TIRUNELVELI MEDICAL COLLEGE, TIRUNELVELI

Dear, Dr.PRIYADHARSHINI.S. MBBS, Tirunelveli Medical College Institutional Ethics Committee (TIREC) reviewed and discussed your application during the IEC meeting held on 10.03.2017

THE FOLLOWING DOCUMENTS WERE REVIEWED AND APPROVED

1.	TIREC Application Form	☐
2.	Study Protocol	☐
3.	Department Research Committee Approval	☐
4.	Patient Information Document and Consent Form in English and Vernacular Language	☐
5.	Investigator's Brochure	☐
6.	Proposed Methods for Patient Accrual Proposed	☐
7.	Curriculum Vitae of the Principal Investigator	☐
8.	Insurance /Compensation Policy	☐
9.	Investigator's Agreement with Sponsor	☐
10.	Investigator's Undertaking	☐
11.	DCGI/DCPT approval	☐
12.	Clinical Trial Agreement (CTA)	☐
13.	Memorandum of Understanding (MOU)/Material Transfer Agreement (MTA)	☐
14.	Clinical Trials Registry-India (CTRI) Registration	☐

THE PROTOCOL IS APPROVED IN ITS PRESENTED FORM ON THE FOLLOWING CONDITIONS

1. The approval is valid for a period of 2 year/s or duration of project whichever is later
2. The date of commencement of study should be informed
3. A written request should be submitted 3weeks before for renewal / extension of the validity
4. An annual status report should be submitted.
5. The TIREC will monitor the study
6. At the time of PI's retirement/leaving the institute, the study responsibility should be transferred to a person cleared by HOD
7. The PI should report to TIREC within 7 days of the occurrence of the SAE. If the SAE is Death, the Bioethics Cell should receive the SAE reporting form within 24 hours of the occurrence.
8. In the events of any protocol amendments, TIREC must be informed and the amendments should be highlighted in clear terms as follows:
   a. The exact alteration/amendment should be specified and indicated where the amendment occurred in the original project. (Page no. Clause no. etc.)
   b. The PI must comment how proposed amendment will affect the ongoing trial. Alteration in the budgetary status, staff requirement should be clearly indicated and the revised budget form should be submitted.
   c. If the amendments require a change in the consent form, the copy of revised Consent Form should be submitted to Ethics Committee for approval. If the amendment demands a re-look at the toxicity or side effects to patients, the same should be documented.
   d. If there are any amendments in the trial design, these must be incorporated in the protocol, and other study documents. These revised documents should be submitted for approval of the IEC, only then can they be implemented.
   e. Approval for amendment changes must be obtained prior to implementation of changes.
   f. The amendment is unlikely to be approved by the IEC unless all the above information is provided.
   g. Any deviation/violation/waiver in the protocol must be informed.

STANDS APPROVED UNDER SEAL

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CERTIFICATE – II

This is to certify that I have verified this dissertation work titled "**A STUDY OF INTRADIALYTIC COMPLICATIONS IN PATIENTS UNDERGOING HEMODIALYSIS"** of the candidate **Dr.PRIYADHARSHINI.S.,**with registration Number **201511356** for the award of M.D. in the branch of General Medicine. I personally verified the urkund.com website for the purpose of plagiarism check. I found that theuploaded thesis file contains from introduction to conclusion page and resultshows **7 percentage**of plagiarism in the dissertation.

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Sources included in the report:

583d2b65f2243_DT 12.1 Clinical Dialysis I_Version_1.doc (D23891264)
https://www.advancedrenaleducation.com/content/intradialytic-hypotension

Instances where selected sources appear:

8

ABBREVIATIONS

HD	-	Haemodialysis
AKJ	-	Acute Kidney Injury
CKD	-	Chronic Kidney Disease
AV Fistula	-	Arterio Venous Fistula
BUN	-	Blood Urea Nitrogen
CNS	-	Central Nervous System
CSF	-	Cerebro spinal Fluid
PTH	-	Parathyroid Hormone
FFP	-	Fresh Frozen plasma
ESRD	-	End stage renal disease
UVB	-	Ultraviolet B
CAD	-	Coronary artery Disease
BP	-	Blood Pressure
SHT	-	Systemic Hypertension

INTRODUCTION

Hemodialysis is the process of removing solutes from the body using a semipermeable artificial membrane when blood comes in contact with the same during extracorporeal circulation. It maintains the fluid and electrolytes in normal homeostasis.The first hemodialysis was successfully done by Dr.WillamKolff.

In Hemodialysis,the dialysis machine and dialyser are used to filter the blood and remove the toxins and excess fluid from the body. The components of haemodialysis are the Dialyzer, the composition and delivery of the dialysate and the blood delivery system. The principle behind Hemodialysis is ultrafiltration and diffusion.

The Hemodialysis procedure is associated with a number of complication. The common complication are hypotension and intradialytic hypertension, dialyzer reactions, disequilibrium syndrome, muscle cramping other less common complications are haemolysis haemorrhage, hypoxia, air embolism and cardiac arrhythmias.

AIM OF THE STUDY

1. To evaluate the various intradialytic complications of Hemodiaysis
2. To identify the Incidence of the intradialytic complication among the patients undergoing HD
3. To study the association between Kidney disease and complications in relation to age and sex distribution

REVIEW OF LITERATURE:

History

Graham (1805 to 1869) invented the process of solute separation in vitro by using semipermeable membranes and the word “dialysis” was coined by him. He was a Scottish professor of chemistry. In 1924 Haas from Germany first used dialysis in humans. Dr. Willem Kolff, a Dutch physician in 1944, used extracorporeal dialysis and successfully treated in patients with acute kidney injury. Kolff was called the “Father of Hemodialysis”.During the initial years following the introduction of hemodialysis, complications were common due to the technical drawbacks associated with the dialysis machines and associated water systems. Currently, the advances in technology, particularly those in the last 20 years, have reduced the complications. However, complications caused by the reasons other than the dialysis machine and water systems remain a significant cause of morbidity and mortality in patients undergoing hemodialysis.

HEMODIALYSIS:

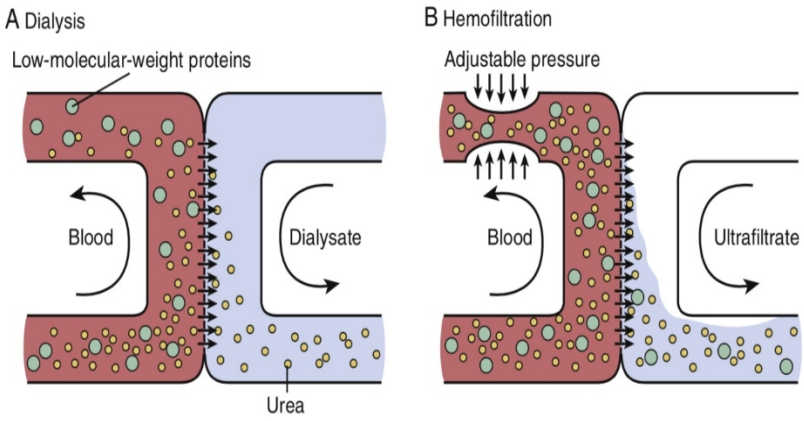
Hemodialysis depends on the principles of solute diffusion across the semipermeable membrane.

Factors determining the rate of diffusive transport across the membrane are magnitude of the concentration gradient, the surface area of the membrane and the mass transfer coefficient of the membrane.

Smaller molecules (such as urea 60 Da) clear easily compared with larger molecules (creatinine 113 Da).

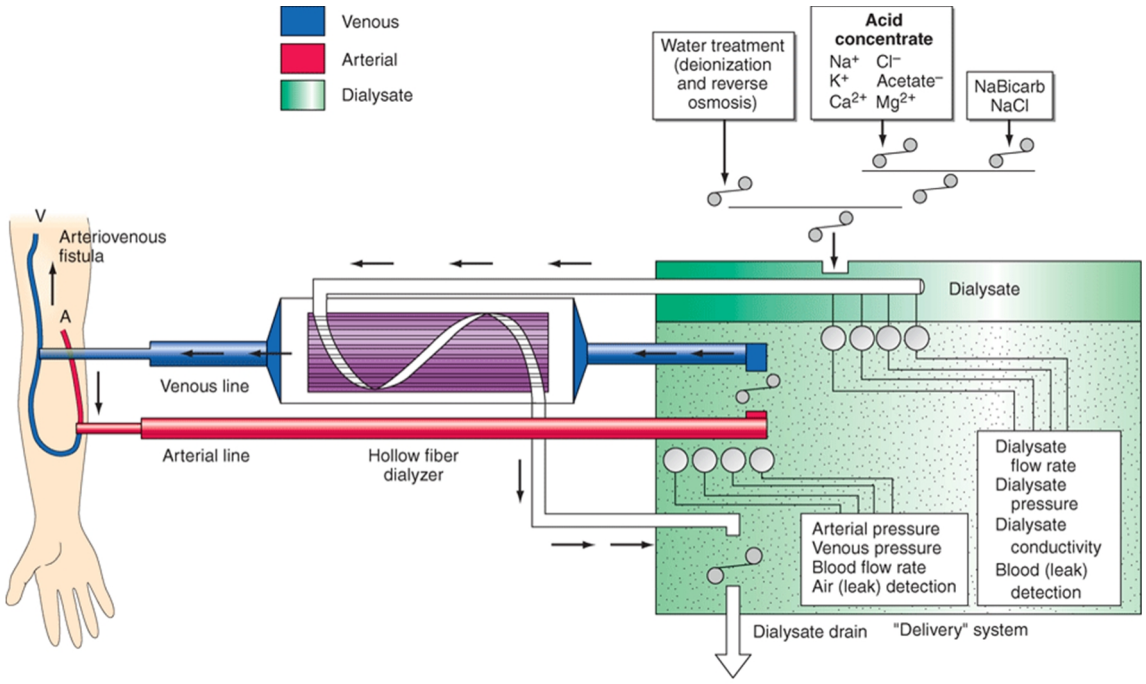
The two types of clearance of the molecules in HD are “diffusive” clearance and “convective” clearance.

The clearance of solutes are the judging factor for the performance of the dialysis.



COMPONENTS OF HEMODIALYSIS:

1. The Dialyzer
2. The composition and delivery of the Dialysate.
3. The blood delivery system.



THE DIALYZER:

It is a plastic chamber. Hollow fibre dialyzer is commonly used and it composed of bundles of capillary tubes and blood circulates on the outside of the fibre bundle.

THE DIALYSATE:

The potassium concentrate varies from 0.4mmol/l and the usual calcium concentration is 2.5meq/lit. Higher calcium concentrations are used in hypocalcemia patients with secondary hyperparathyroidism. The sodium concentration is 136-140 mmol/l

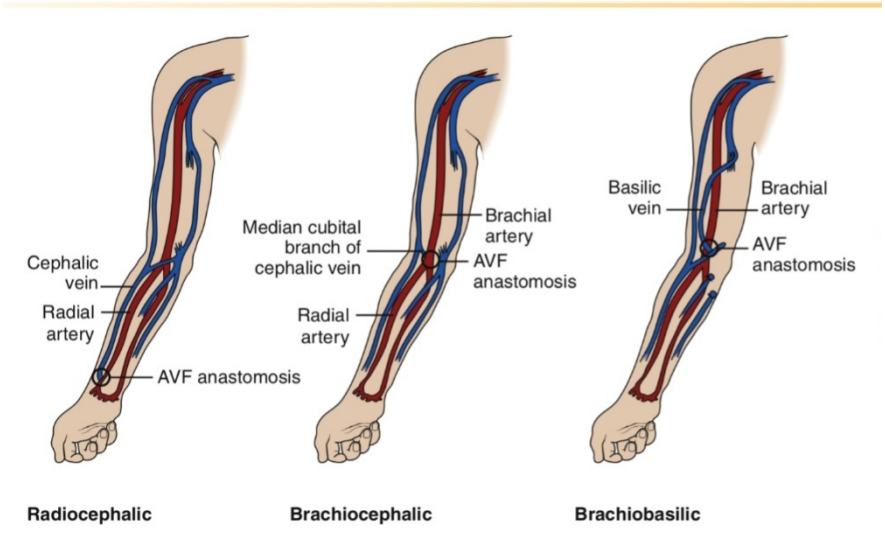
BLOOD DELIVERY SYSTEM:

It consists of extracorporeal circuit and the dialysis access. Blood flow rate varies from 250 to 500ml/min. Commonly used dialysis access is native fistula created by the anastomosis of an artery to a vein (e.g. the bresciacimino fistula) in this cephalic vein is anastomosed end to side to the radial artery.

VASCULAR ACCESS:

The radio-cephalic AV fistula is the access of choice otherwise known as Brescia-Cimino access.

Permanent catheter increases the longevity of the HD (maintanence).



Types of Vascular Access:

1. Arterio venous fistula
2. Arteriovenous grafts

Arterio-venous fistula:

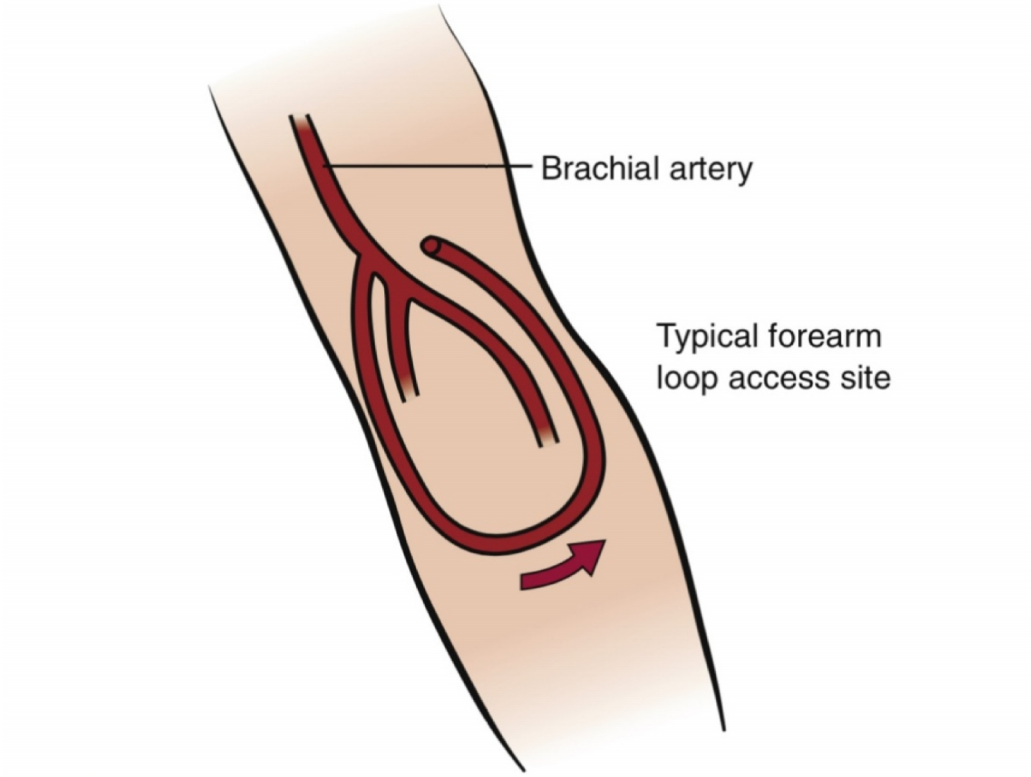
Brescia and colleagues first described this procedure[1].

Pre operative – ultrasonographic images will increases the successfulness of the AV fistula [2].

AV fistula is created by connecting vein and artery, by two approaches,

a. Side to side approach

b. End to side anastomosis



Arteriovenous grafts:

Advantages of this AV grafts are ease of placement and short time requirement. adequate vein is not required in the forearm for this procedures. Advantages of this procedure is low thrombosis rate of graft. Primary patency rate – 12 months for around 50% individuals [3].

COMMON INDICATIONS FOR HEMODIALYSIS:

Chronic kidney disease (CKD) is one among the commonest health problems faced by today's general population. Over millions of people throughout the world are diagnosed with CKD, and among them many require renal replacement therapies such as dialysis and renal transplantation. Among the predisposing factors for CKD, the most common two causes are diabetes and hypertension, thus increasing the prevalence rates in CKD**.**

The mortality rates due to CKD and its related complications would have spiked very high in weeks duration without this protocoled approach in "hemodialysis".

INTRODUCTION TO INTRADIALYTIC COMPLICATIONS OF HEMODIALYSIS:

Cardiovascular complications top among the list of complications with the current practices in hemodialysis. Among the cardiovascular complications, the rate of symptomatic intradialytic hypotension range between 20% and 50%, and it remains an important problem. Another concern is the arrhythmias associated with hemodialysis, the rate of which is reported to be between 5% to 75%. The common and severe type of arrhythmias include ventricular arrhythmias and ectopics. The rate of hemodialysis-associated complex ventricular arrhythmia is around 35%.

The second most common type of arrhythmia is atrial fibrillation, the rate of which is 27%. Sudden cardiac death accounts for 62% of cardiac-related deaths and it is usually attributed to arrhythmias [4].The first year of hemodialysis is of vital importance with respect to sudden cardiac deaths, which was evaluated in 93 of 1000 patients in the first year of hemodialysis [5].

During the early period of introduction of dialysis therapy cramps were observed in 24% to 86% and in contrast with current advances in dialysis the data shows about 2% of the patients having ≥2 hemodialysis sessions in a week suffer from cramps [6].Other common complications include nausea, vomiting with a rate of 5% to 15%, headache with a rate of 5% to 10% and itching with a rate of 5% to 10% [7], [8]**.** Although cramps, nausea, vomiting, headache and itching do not result in mortality, they substantially deteriorate the quality of life in these patients. Although more common during the first years following the introduction of dialysis, disequilibrium syndrome and complications associated with dialyser, water systems and dialysis machines are currently uncommon but may have fatal consequences.

Hemodialysis cause many complications despite the advances in technology. It is of great importance in early recognition and correction of life-threatening complications. Some complications may not threaten the

patient's life but deteriorate the quality of life of the patients. The treatment of these complications provides a longer life and a better quality of life for the patients. Acute complications of hemodialysis can be classified as follows:

- **Complications associated with hemodialysis equipment**
  - Hemodialysis device-related complications
  - Membrane-related complications
  - Water system-related complications
  - Vascular access-related complications
- **Cardiovascular complications**:
  - **Hypotension**: Fluid removal in HD depends on residual urine output of the patient and interdialytic fluid intake with factors like congestive heart failure, female gender and elderly people increase the hypotension events.

Treatment: It is by temporarily reducing the rate of ultrafiltration combined with patient being placed in Trendelenburg position. Replacement of fluid 100 to 250ml of normal saline and (or) albumin. If hypotension still persists, consider other causes such as pericardial disease or myocardial injury.

- Hypertension
- Arrhythmias

- Pericardial effusion
- Chest pain
- Sudden death

- **Neurological complications**
  - **Dialysis Disequilibrium syndrome**: If the solution level is rapidly reduced within a short period of time. Symptoms are mental status changes, generalized seizures and coma.

Mild form- vomiting, headache, restlessness and easy fatigability.

- Cerebrovascular accident
- Consciousness changes
- Headache
- Seizure
- Tremor

- **Complications associated with use of anticoagulant therapy**

- Heparin associated thrombocytopenia
- Bleeding diathesis
- Electrolyte abnormalities
- Hematologic complications

- **Others**
  - Nausea
  - Vomiting

- Itching
- **Muscle cramps:** Reason for this complication is due to excessive and rapid removal of fluid with associated hypotension and electrolyte disturbance.
- **Intradialytic hypotension**

Patient related factors

1. Impaired plasma volume refilling (too high ultrafiltration, autonomic dysfunction)
2. Decreased cardiac reserve (diastolic or systolic dysfunction)
3. Impaired venous compliance
4. Autonomic dysfunction (diabetes, uremia)
5. Arrhythmias
6. Anemia
7. Drug therapy (vasodilators, ß blockers, calcium channel blockers)
8. Alteration of vasoactive substances in blood (low NO, high endothelin-1 andangiotensin-2)
9. Eating during treatment (increased splanchnic blood flow)
10. Too low target weight estimation

Procedure associated factors:

1. Rapid decreases in plasma osmolality (relatively large surface area membrane, highstarting BUN)

2. Excess absolute volume and rate of fluid removal (for fluid overload)
3. Change in serum electrolytes (hypocalcemia, hypokalemia)
4. Dialysate – acetate, warm dialysate
5. Membrane blood interaction
6. Hypoxia (partially patient related)
7. Electrolyte abnormalities

Other less common causes -

1. Pericardial tamponade
2. Myocardial infarction
3. Aortic dissection
4. Internal or external hemorrhage
5. Septicemia
6. Air embolism
7. Pneumothorax
8. Hemolysis

Pathogenesis in Intradialytic hypotension: Vascular instability during dialysis is a multifactorial process in which procedure and patientrelated factors may influence the decrease in plasma volume and induce an impairment ofcardiovascular regulatory mechanisms. An awareness about the risk factors and identifying those patients who might stumble into a

risk may significantly improve cardiovascular stability during dialysis. Among high-risk patients, monitoring and biofeedback of the varioushemodynamic variables, together with an extensive use of convection, can prevent theappearance of symptomatic hypotension and help in averting its onset.

Prevention of Intradialytic hypotension:

Educating the patient should be the first consideration in preventing hypotension. Restrictions of salt consumption should be emphasized so that interdialytic weight gain is limited to 3%. In addition other parameters to be listed are

- Anaemia correction
- Patient end strategy
- Dietary and treatment compliance
- Avoid anti-hypertensive medication on the morning of the dialysis day
- Avoid missing dialysis and stay the entire dialysis time for treatment
- Avoid eating during dialysis

Procedure related strategy:

Dialysate sodium- sodium profiling and sodium gradient protocol but maintaining zerosodium balance to the possible extent.Approach to

reduce the risk of Hypotension by approximating the dialysate Sodium with endogenous sodium [9].Modelling fluid removal- sequential ultrafiltration and dialysis, blood volume controlledhemodialysis. Cool dialysate- isothermic dialysis is well tolerated and clearly reduces the incidenceof hypotension. Reduction of the ultrafiltration rate with prolongation of treatment time, Accurate estimation of dry weight (segmental bio impedance, and others), Judiciously increasing dialysate calcium while avoiding hypercalcemia are other measures that aid the prevention of hypotension.

Treatment:

Stop or reduce ultrafiltration, Place patient in Trendelenburg position. Administration of saline and hypertonic agents. Additional dialysis sessions should be considered in patients gaining weight more than 3%. However, excess fluid replacementshould be avoided to prevent sodium overload.Continuous infusion of pressor agents (meteraminol, norepinephrine) are very rarelyneeded.

Midodrine an alpha 1 agonist given approximately 30 min before dialysis significantly reduces theincidence of hypotension. It has been considered safe and is well tolerated.It is initially started at a dose of 2.5 mg and then titrated to a maximum of 30 mg.

Carnitine has been recommended in-patients with frequent hypotensiveepisodes.It acts by carrying long chain fatty acids to mitochondria Given as intravenous administration of 20mg/kg during each session. Sertraline,an SSRI in doses of 50 to 100mg per day decreases intradialytic hypotension

INTRADIALYTIC HYPERTENSION

Most proposed mechanism for intradialytic hypertension is a state of salt and volume excess. Other mechanisms include increased sympathetic activity, activation of renin angiotensin system, endothelial cell dysfunction, vascular stiffness, erythropoietin stimulating agents, hypercalcemia, hypokalemia and stoppage of anti-hypertensives during dialysis .

Pre-dialysis Blood pressure target of 140/90 mmHg and post dialysis target of 130/80 mmHg is recommended

Treatment and Prevention

Lifestyle modifications such as weight reduction, dietary modification, sodium restriction, physical activity and abstinence from alcohol consumption can reducesystolic blood pressure from 2-14 mm Hg. Adjustment of target weight on a regular basis. Gradual reduction of interdialyticweight gain over a few weeks using zero sodium balance, salt

restriction, longerdialysis or extra dialysis sessions may yield a significant benefit. Reducing erythropoeitin dose in patients with severe hypertension and withholding anti-hypertensive medications on the day of dialysis. Calcium channel blockers are non dialyzable and can safely be used as a second line of treatment in patients with heart failure. Nephrectomy may be considered resistant cases. Renal transplantation or conversion to peritoneal dialysis can also be considered (PD) [10].

DIALYZER REACTIONS

Reactions attributed to the hemodialyzer are generally divided into two types:

- **Type A - anaphylactoid reaction**

Increased risk in patients with a history of atopy, high IgE levels, eosinophilia andallergic reactions during dialysis

- **Type B - mild reaction**

*Diagnosis:*Type A reaction are severe and rapid in onset, Rare (7.0 per 1000 patient year). Established by three major criteria or two major and one minor criterion

- **Major criteria**

Onset within 20 minutes of starting dialysis, dyspnea, burning/heat sensation at the access site or throughout the body and angioedema.

- **Minor criteria**

Reproducible during subsequent dialysis when using the same type or

brand of dialyzer, urticaria, rhinorrhea or lacrimation, abdominal cramping, and itching.

Etiology: Use of ethylene oxide (ETO) for sterilization of dialyzer and polyacrylonitrilemembranes (PAN) membranes, especially AN69 in patients on ACE-inhibitors

*Type B reaction:*Primary symptoms are chest and back pain, that occur in 20-40 minutes during the dialysis treatment.It disappears or lessens dramatically during the subsequent hours of dialysis. Pathogenesis behind type B reaction is not clear.There is a probable relation with complement activation [11].

DISEQUILIBRIUM SYNDROME

Disequilibrium syndrome most commonly occurs during the first few dialysis sessions, in elderly and pediatric patients, patients with pre-existing CNS lesions (recent stroke, head trauma) or conditionscharacterized by cerebral edema (malignant hypertension,

hyponatremia, hepaticencephalopathy), high pre-dialysis BUN, severe metabolic acidosis

Etiology: Cerebral edema resulting from urea removal from the blood more rapidly than fromthe CSF and brain tissue results in generation of urea osmotic gradient.It is responsible for water moving into the brain cells.HD generates a CO2 gradient between plasma and CSF lowering the pH in the CSFand brain tissue. This change promotes an increase in brain cell osmolality due tothe rise in H+ concentration and the in-situ generation of osmotic concentration (acid radicals fromprotein metabolism) resulting in brain edema.

Treatment: Usually self-limited. However, for severe symptoms HD should be stopped.If seizures occur, glucose, diazepam, phenytoin loading followed by infusion of osmotically active agents in dialysate have been tried- albumin, glycerol, mannitol).

Prevention: Identify high risk patients, reduce dialysis efficacy and limit urea reduction to 30% (smaller dialyzer, decreasingblood flow, sequential dialysis increasing dialysis time), however, a recent smallseries found tolerance to higher urea reduction. Prophylactic administration of osmotically active agents (mannitol, glucose, fructose)and using high sodium dialysate, IV mannitol 20% at 50 ml/hr with intravenous diazepam

is a simple way to prevent disequilibrium syndrome in high risk patients [12].

CRAMPING

Etiology: Approximately 20% of dialysis sessions are accompanied by muscle cramps, which are more pronounced in patients who require high ultrafitration rates and arepossibly dialyzed below their dry weight. They are presumably related to reduction in muscle perfusion that occur in response to hypovolemia. Compensatoryvasoconstrictive responses may shunt blood centrally during treatment, and couldplay a role in promoting muscle cramps.

Changes in intra or extracellular balance of potassium and concentration of ionizedcalcium can disturb neuromuscular transmission and produce cramps.

Peripheral vascular disease, although common in dialysis patients, may not beassociated with increased prevalence of intradialytic cramps which confirms thatprocesses related to the dialytic treatment are responsible for the cramps, Middle molecule named leptin that is increased in HD patients. It has an association with intradialytic cramping episodes [13].

*Differential Diagnosis:*While the majority of cramps are associated with dialysis treatment, the differentialdiagnosis is extensive and includes the following conditions:

- Idiopathic cramps
- Contractures (occurring in conditions such as metabolic myopathies, and thyroiddisease)
- Tetany (due to hypocalcemia or alkalosis)
- Dystonias (occupational cramps, anti-psychotic medications)
- Other leg problems such as restless leg syndromes and periodic leg movements,must be distinguished from cramps

Treatment and Prevention: Many of the treatment strategies are similar to those used to treat intradialytichypotension. Physical manoeuvres such as massage of the calf muscles and dorsiflexion of the footare not very helpful. Immediate treatment is to increase intravascular volume by interrupting or slowingultrafiltration and administering saline, mannitol or glucose. In addition to effecting an intravascular shift of water, hypertonic solutions may directly improve blood flow to the muscles and use of dialysate sodium, potassium or calcium modelling. The concept ofindividualization of dialysate composition seems to be a good preventive method.Careful reassessment of the dry weight, counseling the patient to reduce interdialyticweight gain and using bicarbonate dialysis. L-

Carnitine [14]. and Vitamin E [15]. administration may reduce the incidence of cramping.

- **AIR EMBOLISM**

*Etiology:*Can be venous or less commonly, arterial. Three vulnerable areas of air entry in dialysis patients:

1. Between patient and blood pump, due to high negative pressure and leaks inthe circuit of the segment
2. Air in the dialysate fluid (uncommon, mostly gets trapped in venous chamber)
3. During central venous catheter insertion or removal. Upright body position and hypovolemia, both by reducing venous pressure, aresignificant contributing factors[16].

   Treatment: Prevent further air entry by clamping and disconnecting the circuit. Flat supine position may be better over traditionally advocated left lateral (Duran'sposition) and Trendelenburg position. Oxygen with FiO 100%, Hyperbaric oxygen (prevents cerebral edema), use of Luer-lock syringes for blood draw from catheters.

Prevention: Test machine prior to use to ensure that the air detector alarm system is workingeffectively. Catheter insertion or removal should be in a head low position (insertion site 5 cmbelow right atrium). Patient can assist

by holding their breath or doing a Valsalvamaneuver that will increase central venous pressure.

- **HEMOLYSIS**

Etiology:

1. Mechanical
2. High blood pump flow
3. Single-needle dialysis
4. Small gauge cannula
5. Kinked blood lines
6. High negative arterial pressure
7. Offset blood pump
8. Failure of rinsing
9. Hydrogen peroxide
10. Contamination with hypochlorite, formaldehyde
11. Priming error
12. Hypotonic saline
13. Dialysate error
14. Hyper or hypotonic dialysate
15. Overheated dialysate
16. Dialysate contamination
17. Chloramines

18.Nitrates

19.Copper

*Treatment:*Stop blood pump, clamp venous bloodline and discard the blood. Provide oxygen to the patient. Arrange for blood transfusion if needed. Resume HD as soon as patient is stabilized, since hyperkalemia accompanies

hemolysis.

*Prevention:*Test machine prior to use to ensure that the air detector alarm system is workingeffectively. Avoid chemical contaminants that can damage RBCs, oxidants such as chloramines, copper, zinc, reducing agents such as formaldehyde, hypo or hypertonic dialysate, overheated dialysate, small needles and highly negative arterial pressure alarms. Ensure correct positioning of tubing in the roller pumps

- **CARDIAC ARRYTHMIAS**

Risk factors

- Left ventricular hypertrophy
- Heart failure
- Ischemic heart disease
- Other factors: Age, respiratory failure, rapid reduction of extra-cellular volume, electrolyte and acid-base derangement, cardiac and

major vascular surgery, digoxin therapy, sympathetic dysfunction, increased phosphate and PTH, high risk in those with reduced heart rate variability and increased QT dispersion [17].

Diagnosis and Treatment

Monitor serum electrolytes, bicarbonate and glucose levels, ECG, oxygen, IV fluids. May need to discontinue HD. Correct electrolyte disturbance (especially potassium,calcium and magnesium). Cardioversion with AED (automated external defibrillator) in case patient ishemodynamically unstable and has a treatable rhythm. Digoxin can be used to control ventricular rate in SVT.

Patients on digitalis might need increase of the dialysate potassium to 3-3.5

mEq/L to prevent hypokalemia.Amiodarone can be used in usual dose for ventricular arrhythmias. Intracellular shift of potassium can be minimized by reducing dialysate glucose (from200 to 100 mg/dl), and when acid base status permits, bicarbonate level.

Prevention:

Avoidance of low hemoglobin levels and hypoxia during dialysis. Maintenance ofoptimal calcium, phosphate and PTH levels and usage of oxygen.

- **HAEMORRHAGE**

Risk Factors: Platelet dysfunction, Ineffective platelet-vessel wall interaction and heparin induced thrombocytopenia(HIT), use of anti-coagulation during HD, co-morbid conditions, uncontrolled hypertension, liver disease, sepsis, certain medication (especially anti-platelet drugs), Access site kept covered, Venous needle falling out or catheter connection disrupted (venous pressure may falltoo little to cause an alarm).

*Risk Assessment:*Very high - Active bleeding during HD, High - Surgical/traumatic wound within 3 days, Low - Surgical/traumatic wound > 7 days.

*Diagnosis and Treatment:*Screen for bleeding and activated clotting time, prolonged bleeding time - cryoprecipitate, DDAVP or conjugated estrogen, acutely prolonged PTT (heparin induced) - Protamine, FFP.

*Prevention:*Should never keep access site covered, review heparin dose, strategy based on risk assessment, low risk - low dose conventional heparin, low molecular weight heparin, very high/high risk - regional

anticoagulation with heparin and protamine, heparinfree dialysis, regional citrate anticoagulation, Prostaglandin (PGI2), PD, alternative Methods to Conventional Heparin for high-risk patients

- **HYPOXIA**

During hemodialysis, PaO2 falls about 10-20 mmHg. This decrease has no clinicalconsequences in patients with normal oxygen tension, but in seriously ill patients withpredialysis hypoxemia, the drop in PaO2 can be catastrophic.

Etiology:

Acetate dialysate (now obsolete). Can also be seen with use of bicarbonate

Dialysate. Acetate causes hypoxemia by at least two mechanisms:

- Increased oxygen consumption in the metabolism of acetate to bicarbonate
- Intradialytic loss of CO2
- Rapid correction of chronic metabolic acidosis
- Bioincompatible membranes
- Activation of complement

Hypocapnea due to intradialytic loss of CO2 and adaptation to chronic metabolicacidosis predisposes to periodic breathing and sleep apnea syndrome (SAS). SAS is also a cause of hypoxia in HD patients. High

prevalence in HD patients (54-80%) and has both obstructive and centralcomponents.Can alter autonomic responses and cause arrhythmias, pulmonaryhypertension, and systemic hypertension.

Treatment and Prevention

Dialysis-induced hypoxemia can be attenuated by interventions that increase the CO2 content of the dialysate either by direct administration or by using bicarbonatebuffered dialysate. Use of biocompatible membranes might be helpful in critically ill patients who may already have some degree of pre-dialytic hypoxia, it isnecessary to increase the ventilated volumes and/or the percentage of FiO2 improvement in SAS has been reported with the use of prolonged dialysis such asnocturnal and daily hemodialysis

- **PRURITIS**

Etiology:

Common abnormalities in ESRD play a role in pathogenesis such as:

- Xerosis (dry skin)
- Peripheral neuropathy
- Hypercalcemia
- Hyperphosphatemia
- Hypermagnesemia

- Zinc depletion
- Hypervitaminosis A

No correlation found between standard biochemical tests (blood urea nitrogen,creatinine, calcium, phosphate, parathyroid hormone) and uremic pruritus. Chronic inflammation might have a probable role. Relationship between pruritus and type of dialyzer is not clear.

Treatment:

Empirical, individualized and often ineffective. Skin emollients, capsaicin, H-1 receptor antagonist, phototherapy (UVB).

Newer drugs: Thalidomide, nicergoline, lidocain, mexiletine, cholestyramine,cromolyn sodium and Gabapentin. Other modalities: Acupuncture, electric needle stimulation and sauna, parathyroidectomy and renal transplantation in recalcitrant cases

Prevention:

Optimizing calcium, phosphate, magnesium, PTH and delivered dose of dialysis(greatly reduced at Kt/V > 1.5). Avoidance of dialysis related factors such as iodine, ethylene oxide. Find out any allergy to heparin. Biocompatible membrane can be used preferably. Parathyroidectomy is also considered for treatment. Renal transplantation is the only definitive treatment

- **FEBRILE REACTIONS**

Febrile reactions are defined as a rise in temperature during HD of at least 0.5° C or arectal or axillary temperature during dialysis of at least 38.0 or 37.5° C respectively .Themajority (70%) of febrile reactions are associated with pre-existing infections (vascularaccess, urinary and respiratory) .

HD related febrile reactions can be associated with localized infection of the vascularaccess site (especially catheters and grafts) or products from the dialysate and/or theapparatus used for HD treatment

Diagnosis and Treatment:

- Obtain blood cultures
- Begin broad spectrum antibiotics immediately
- Treatment largely supportive and empirical
- Cluster of similar cases should prompt a review of:

1. Water used for reprocessing dialysate
2. Processing procedure
3. Bicarbonate system

Prevention:

- Reduce the use of catheters for HD
- Reduce the susceptibility to infections by:
- Provide adequate HD

- Prevent and/or treat malnutrition
- Optimize hemoglobin concentration
- Avoid iron overload
- Use biocompatible dialysis membrane
- Reduce S. aureus infections by screening nasal carriers and treating with mupirocin.

- **METABOLIC ACIDOSIS**

Can occur accidentally as a consequence of dialysate fluid containing improper ratiosof acid and base concentrates in the form of acetate or bicarbonate. Develops as a result of the accidental use of an acidic concentrate instead ofacetate or bicarbonate and due to computer software malfunction of the machine. Severe metabolic acidosis has been reported during first 2 hours of HD using sorbentregenerative hemodialysis in mechanically ventilated patients

Treatment: consists of intravenous administration of bicarbonate and dialysis withbicarbonate dialysate of a correct concentration (38-40 mEq/L)

The mainstay of prevention is to fit all HD machines with a pH meter and alarms thatwill prevent the extreme acid load, which may be caused by an inappropriatelyprepared bicarbonate dialysate. Conductivity checks are vital.

- **METABOLIC ALKALOSIS**

The most common cause is the loss of hydrochloric acid as a result of vomiting ornasogastric suction.

Less common causes:Technical errors during HD, Malfunction of the dialysis machine's pH monitor and proportioning system (thereversed connection of bicarbonate and acid concentrate containers to the entry ports)

Severe metabolic alkalosis may cause:

- Tissue hypoxia
- Arrhythmia
- Seizure
- Delirium
- Stupor

Applying HD therapy with specially formulated low-bicarbonate, low-acetate, or aciddialyses are safe and effective intervention for severe metabolic alkalosis. Severemetabolic alkalosis can be corrected rapidly and safely with bicarbonate concentratesdialysate between 25-28 mEq/L .

- **HYPOKALEMIA**

Severe intradialytic hypokalemia can occur even when the dialysate contains ahigher potassium concentration than the predialysis serum

potassium concentration. The cause of the hypokalemia is a rapid shift of potassium from the extracellular tothe intracellular space secondary to correction of acidosis

Dialysis induced hyperkalemia is rare.

Reported causes of hypokalemia include:

- History suggesting prolonged potassium loss
- Marked acidosis
- Baseline moderate hypokalemia

Prevention and Treatment

Excess potassium removal during HD can prolong QTc interval on ECG preferentiallyand predispose to arrhythmia. Try to keep post dialysis serum potassium 2-3 mEq/L. Use dialysate with 3.0 mEq/l of potassium in patients with CAD and/or on digoxin,unless there is chronic, severe hyperkalemia. Never use 0 mEq/L potassium dialysate. Use of very low dialysate potassium (1mEq/L) should be discouraged.

- **HYPERKALEMIA**

Common in ESRD (around 10% of HD patients).Contributes to 3-5% of deaths [18].

Etiology:

- Excessive dietary potassium intake
- Metabolic acidosis
- Acute infection with marked catabolism
- Rhabdomyolysis
- Mineralocorticoid deficiency
- Medications
- Dialysis induced hyperkalemia (rare)
- High dialysate potassium concentration
- Haemolysis

- **HYPERNATREMIA**

Hypernatremia can occur when sodium concentration is high and the conductivitymonitors of the dialysis machine are not functioning or the alarms are not set properly. Dialysate conductivity can be incorrectly sensed as low by the coated conductivitycells (that gets coated by granules from less soluble batch of sodium bicarbonatepowder). At the start of dialysis if an error is made when connecting concentratecontainers. Also occur during dialysis if containers run dry and conductivity monitor fail [19].

Treatment:

Dialysis can be resumed with dialysate sodium 2 mEq/L lower than plasma sodiumconcentration while infusing isotonic saline. Use of dialysate sodium 3-5 mEq/L lowerthan plasma sodium might increase the risk of disequilibrium syndrome.

Prevention:

Frequent check of conductivity monitors which can get coated with bicarbonategranules and can cause falsely low readings.

- **HYPONATREMIA**

Hyponatremia can occur at the start of dialysis if an error is made when connecting concentratecontainers. During dialysis if containers run dry and conductivity monitor fails [20].

Treatment:

- Clamp the bloodlines
- Discard the blood present in the dialysis tubing (as acute hyponatremia during HD isfrequently associated with hemolysis and hyperkalemia)
- Anticonvulsants and blood transfusion may be needed

Rapid correction of hyponatremia in HD patients may not be dangerous (except forone case report)

Current recommendation would be to correct hyponatremia using the guidelinescurrently accepted for nonuremic patients

Prevention:

Dialysate sodium level should be higher than that in plasma.

MATERIALS AND METHODS:

Type of Study: Prospective observational study

Study population and period : Patients admitted in hemodialysis unit, Tirunelveli Medical College and Hospital from the period of January 2017 to December 2017.

Sample size: 190 patients.

Inclusion criteria:

1. Patients over 13 years of age
2. Patients with Chronic Kidney Disease (CKD)
3. Acute Kidney Injury (AKI) were selected.

Exclusion Criteria:

1. Pregnant women
2. Patients below 13 years of age.

Methodology: The study was approved by ethical committee of the

Hospital. Non probability consecutive technique was used. The first 190 consecutive patients diagnosed with ARF and CKD were admitted in hemodialysis unit from January 2017 to December 2017, who met within the inclusion criteria were recruited for the study.

After obtaining informed consent, patients were monitored and evaluated thoroughly in recording the intradialytic complications with hemodialysis. Incidence of complications with patients undergoing hemodialysis, most common type of complications and how to treat such complications were analysed.

STUDY ANALYSIS:

Statistical assessment was performed using chi-square analysis with continuity correction and students t-test to identify the difference between patient with and without intradialytic complications. Statistical significance was assumed when the probability value was less than 0.05. Data was analysed using SPSS-11. Data was expressed as mean ± 2SD and percentage

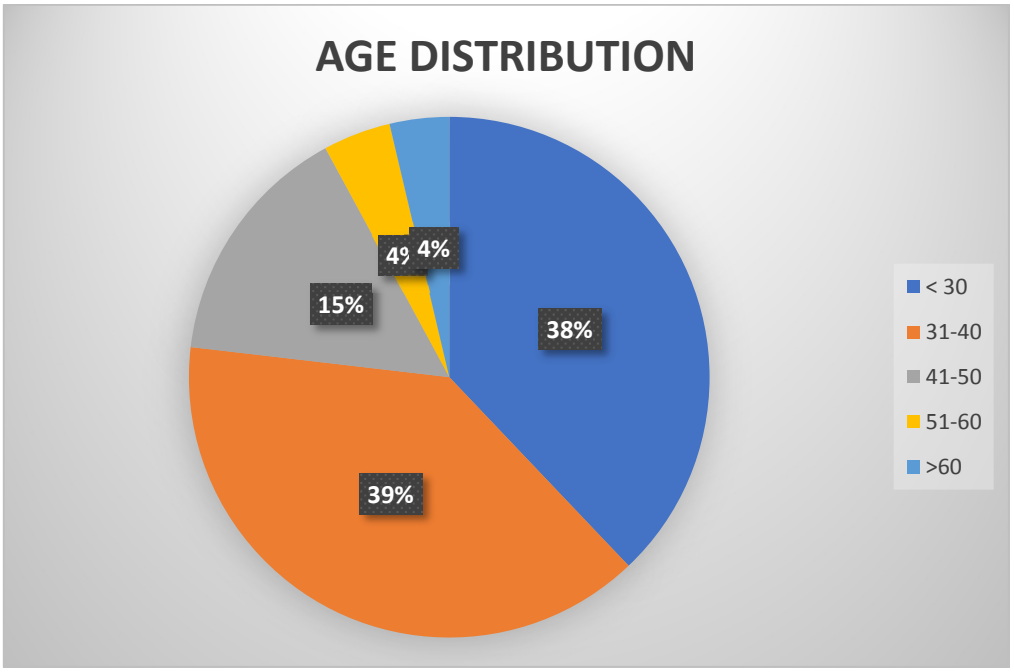
OBSERVATION AND RESULTS:

Table -1 : AGE WISE DISTRIBUTION OF PATIENTS ON HD

We included 190 total patients who are above 13 years of age.

S.No	AGE IN YEARS	NO OF PATIENTS	PERCENTAGE
1	< 30	72	38%
2	31-40	74	39%
3	41-50	29	15%
4	51-60	8	4%
5	>60	7	4%

Figure -1 : AGE WISE DISTRIBUTION OF PATIENTS ON HD

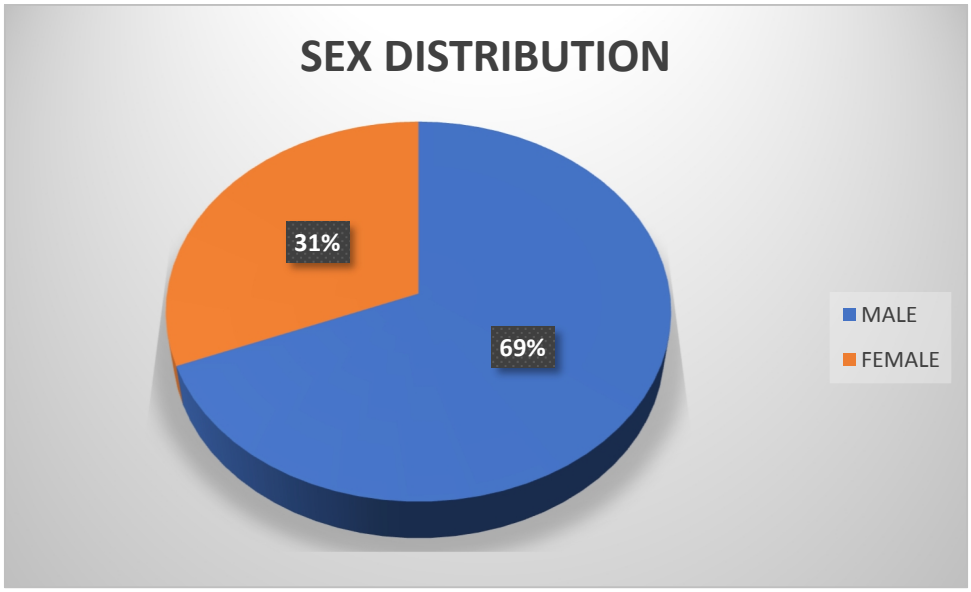


Among our patients for hemodialysis, 31 to 40 years of age groups constituted 39% and >60 Years was only 4%.

Table-2 : SEX WISE DISTRIBUTION OF PATIENTS ON HD

S.No	SEX	NO OF PATIENTS	PERCENTAGE
1	MALE	131	69%
2	FEMALE	59	31%

Figure -2 : SEX WISE DISTRIBUTION OF PATIENTS ON HD

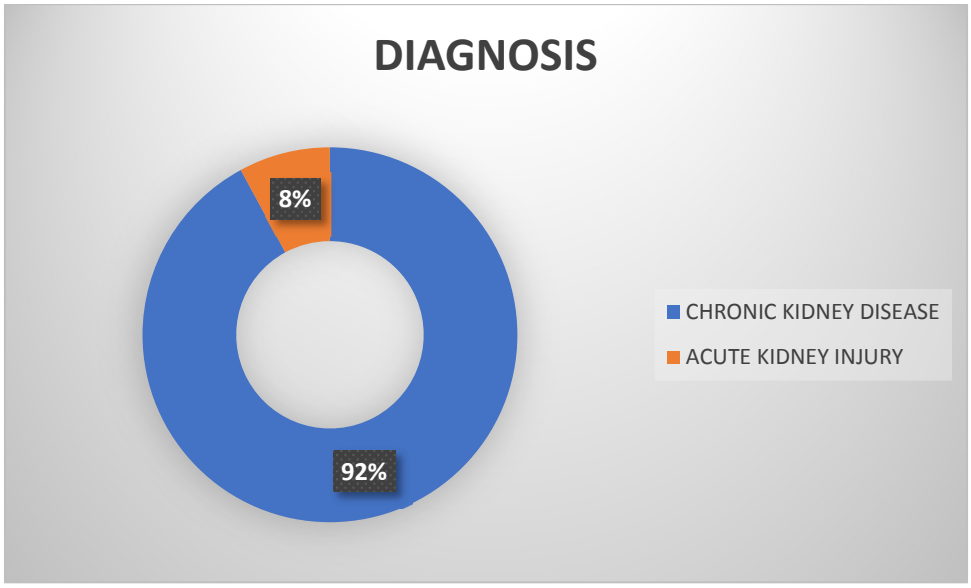


Out of 190 patients, 69% were Male patientsand 31% were females.

Table-3 PREVALENCE OF ACUTE AND CHRONIC KIDNEY DISEASE

S.No	DIAGNOSIS	NO OF PATIENTS	PERCENTAGE
1	CHRONIC KIDNEY DISEASE	175	92%
2	ACUTE KIDNEY INJURY	15	8%

Figure -3 PREVALENCE OF ACUTE AND CHRONIC KIDNEY DISEASE

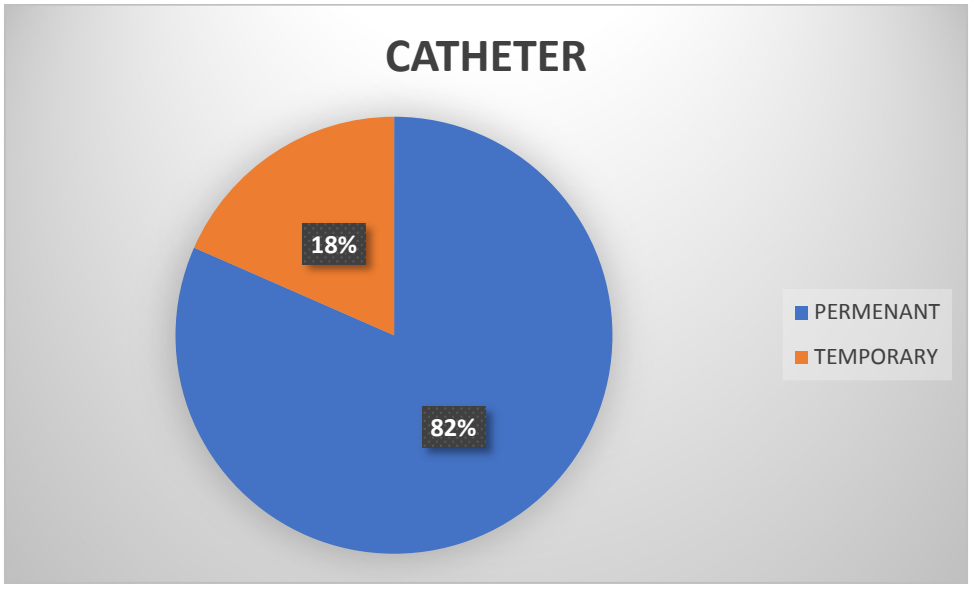


Out of 190 patients, CKD patients were more than AKI (CKD-92%)

Table-4 DISTRIBUTION OF PATIENTS ON HD WITH CATHETER IN SITU

S.No	CATHETER	NO OF PATIENTS	PERCENTAGE
1	PERMANENT	155	82%
2	TEMPORARY	35	18%

Figure -4 DISTRIBUTION OF PATIENTS ON HD WITH CATHETER IN SITU

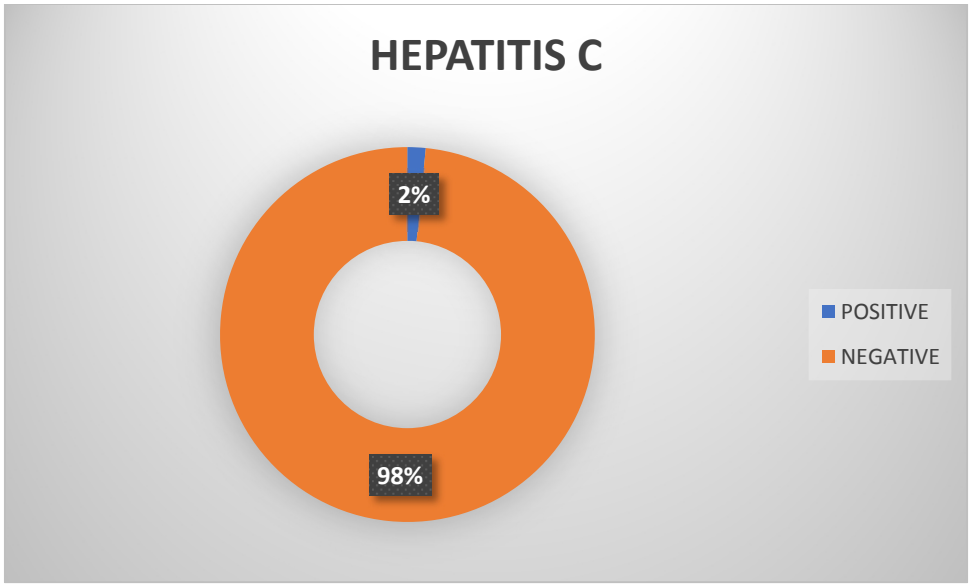


Among the 190 patients, patients with permanent catheter were more than temporarily catheterised patients (permanent catheter-82%)

Table-5 HEPATITIS C POSITIVITY IN HD PATIENTS

HEPATITIS C	NO OF PATIENTS	PERCENTAGE
POSITIVE	3	2%
NEGATIVE	187	98%
COMPLICATIONS	Nil	Nil

Figure -5 HEPATITIS C POSITIVITY IN HD PATIENTS

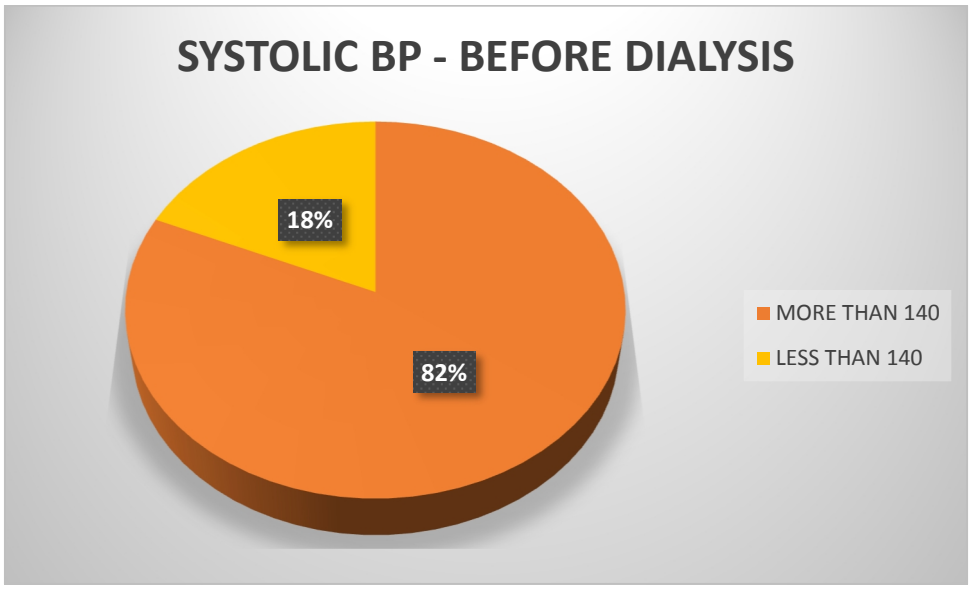


2% of patients were confirmed to be positive with hepatitis C, no specific complications in HCV infected individuals.

Table-6 SYSTOLIC BP –BEFORE DIALYSIS

S.No	SYSTOLIC BP - BEFORE DIALYSIS	NO OF PATIENTS	PERCENTAGE
1	MORE THAN 140mmhg	155	82%
2	LESS THAN 140mmhg	35	18%

Figure -6 SYSTOLIC BP –BEFORE DIALYSIS

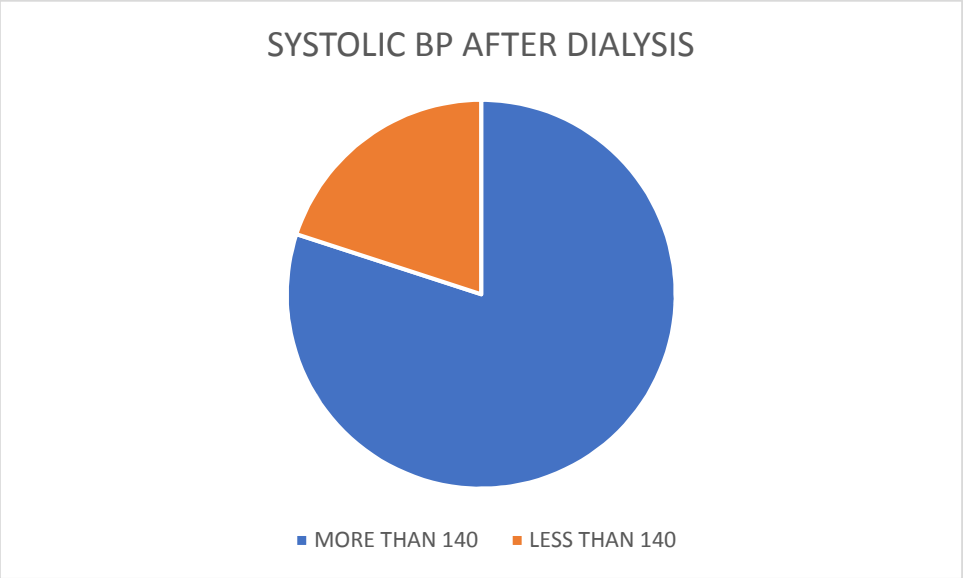


82% of the patients were hypertensive. Among the 190 Patients 155 patients Blood pressure were more than 140mmHg.

Table-7 SYSTOLIC BP – AFTER DIALYSIS

S.No	SYSTOLIC BP - AFTER DIALYSIS	NO OF PATIENTS	PERCENTAGE
1	MORE THAN 140mmhg	152	82%
2	LESS THAN 140mmhg	38	18%

FIGURE -7 SYSTOLIC BP – AFTER DIALYSIS

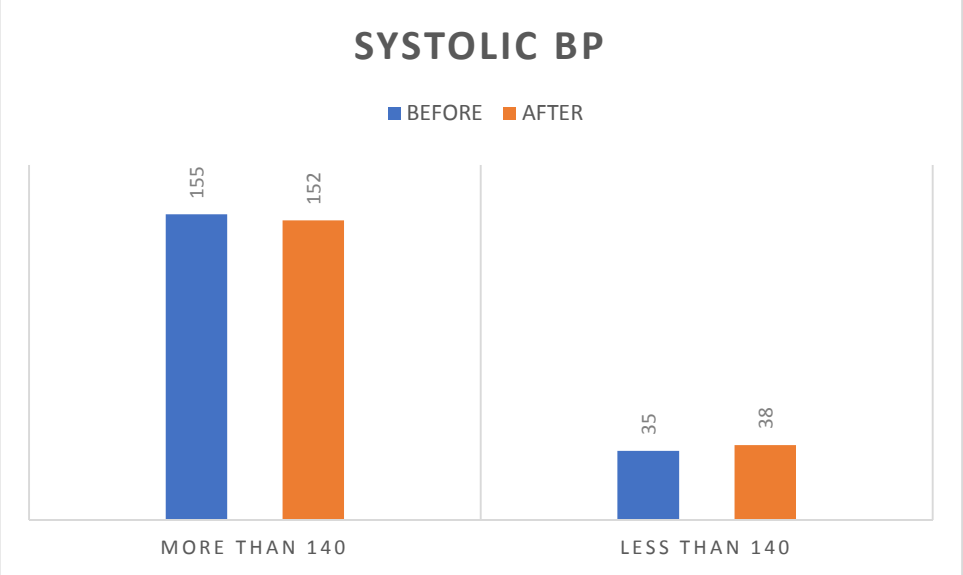


Post-hemodialysis, the blood pressure raise above normal stayed in 82%

Table-8 COMPARISON OF SYSTOLIC BP BEFORE AND AFTER HEMODIALYSIS

S.No	SYSTOLIC BP	BEFORE	AFTER
1	MORE THAN 140mmhg	155(82%)	152(82%)
2	LESS THAN 140mmhg	35(18%)	38(18%)

Figure -8 COMPARISON OF SYSTOLIC BP BEFORE AND AFTER HEMODIALYSIS

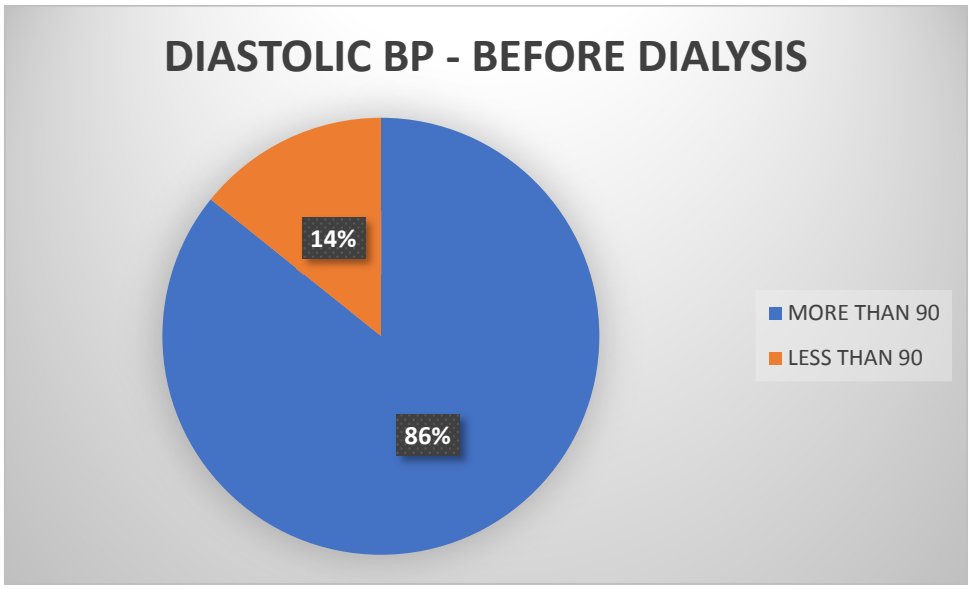


Patients with systolic pressure before and after the hemodialysis sessions.

Table-9 DIASTOLIC BP – BEFORE DIALYSIS

S.No	DIASTOLIC BP - BEFORE DIALYSIS	NO OF PATIENTS	PERCENTAGE
1	MORE THAN 90mmhg	163	86%
2	LESS THAN 90mmhg	27	14%

Figure -9 DIASTOLIC BP – BEFORE DIALYSIS

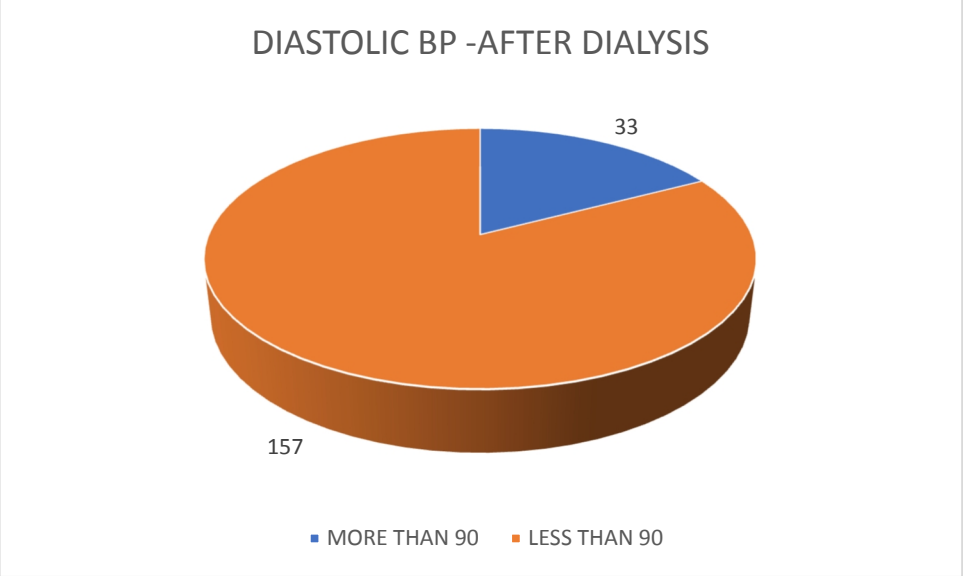


Diastolic pressure before dialysis were higher than normal in 86% of the patients

Table-10 DIASTOLIC BP AFTER DIALYSIS

S.No	DIASTOLIC BP - AFTER DIALYSIS	NO OF PATIENTS	PERCENTAGE
1	MORE THAN 90mmhg	33	17%
2	LESS THAN 90mmhg	157	83%

Figure -10 DIASTOLIC BP AFTER DIALYSIS

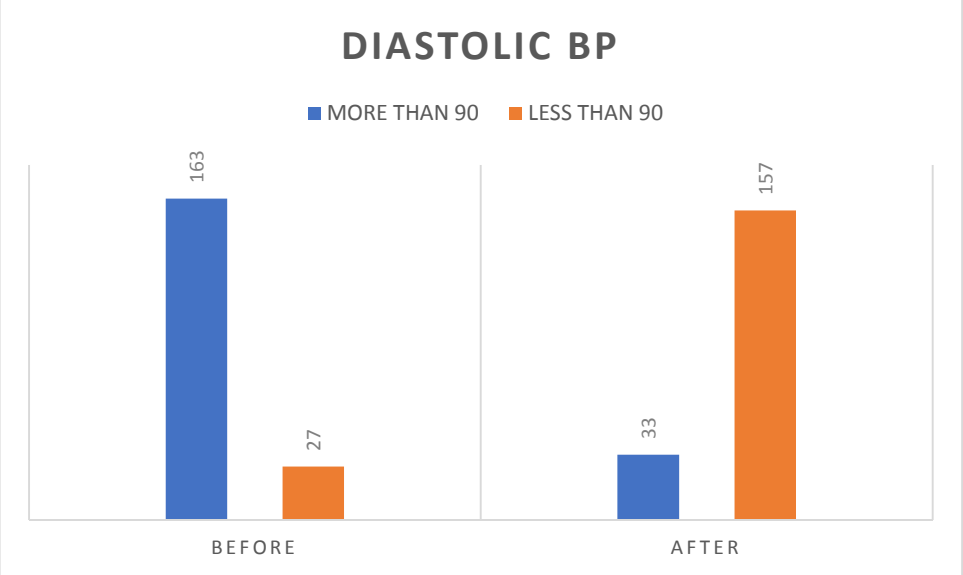


Interestingly, diastolic pressure had a fall below 90mm Hg in 83% of the patients

Table-11 COMPARISON OF DIASTOLIC BP BEFORE AND AFTER HD

S.No	DIASTOLIC BP	BEFORE	AFTER
1	MORE THAN 90mmhg	163(86%)	33(17%)
2	LESS THAN 90mmg	27(14%)	157(83%)

Figure -11 COMPARISON OF DIASTOLIC BP BEFORE AND AFTER HD

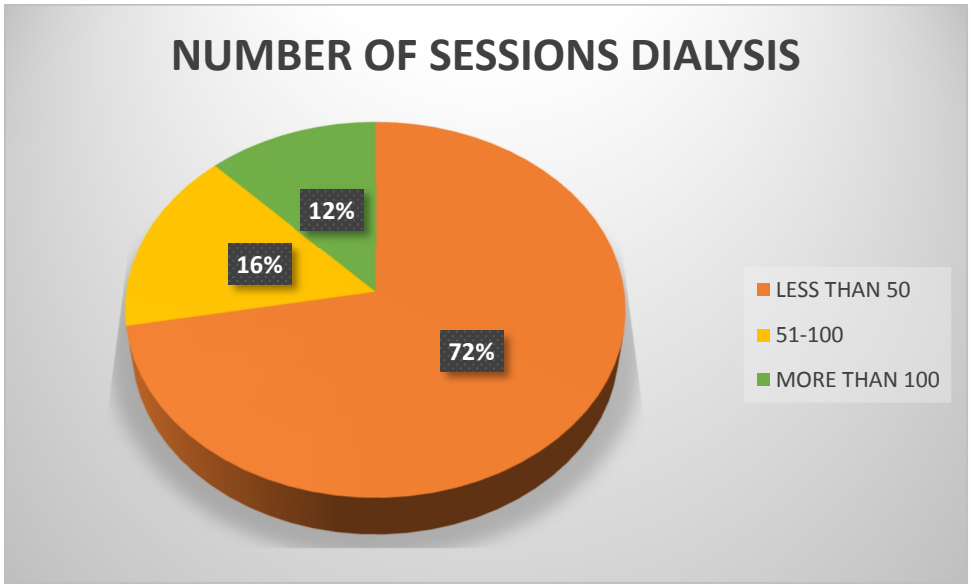


A significant difference in diastolic pressure was recorded before and after hemodialysis

Table-12 PATTERN OF DISTRIBUTION OF COMLICATIONS WITH NUMBER OF SESSIONS OF HD

S. No	NO OF SESSION OF DIALYSIS	NO OF PATIENTS	PERCENTAGE
1	LESS THAN 50	137	72%
2	51-100	30	16%
3	MORE THAN 100	23	12%

Figure -12 PATTERN OF DISTRIBUTION OF COMLICATIONS WITH NUMBER OF SESSIONS OF HD

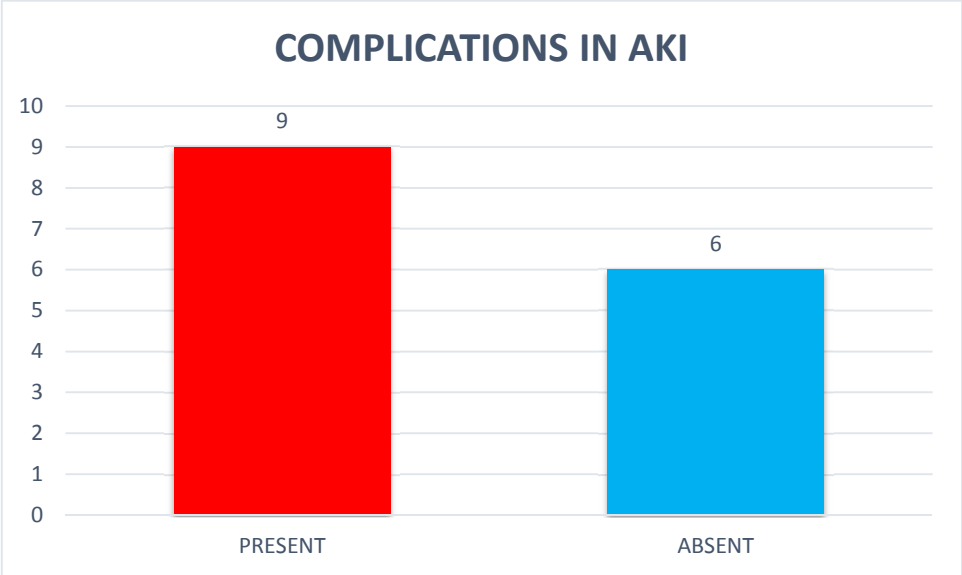


Number of sessions of hemodialysis within our patient group. 72% of patients underwent hemodialysis less than 50 times

Table-13 COMPLICATIONS IN AKI

S.No	COMPLICATIONS OF AKI(N=15)	NO OF PATIENTS	PERCENTAGE
1	PRESENT	9	60%
2	ABSENT	6	40%

Figure -13 COMPLICATIONS IN AKI

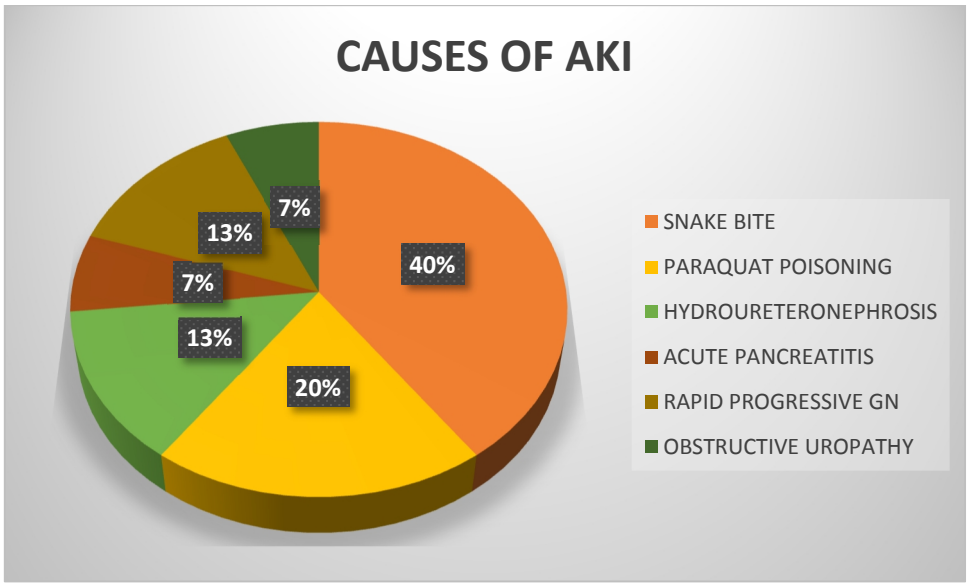


Among 15 patients 9 (60%) patients developed complications

TABLE 14: CAUSES OF AKI

S.No	COMPLICATIONS	NO OF PATIENTS	PERCENTAGE
1	SNAKE BITE	6	40%
2	PARAQUAT POISONING	3	20%
3	HYDROURETERONEPHROSIS	2	13%
4	RAPID PROGRESSIVE GN	2	13%
5	ACUTE PANCREATITIS	1	7%
6	OBSTRUCTIVE UROPATHY	1	7%

Figure-14 : CAUSES OF AKI

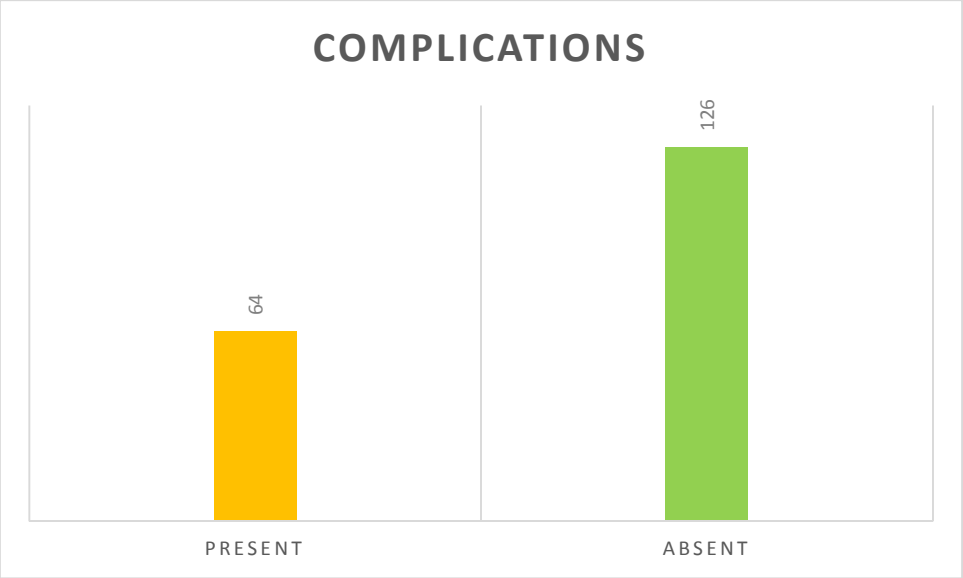


Among the 15 AKI patients 6 (40%) is due to snake bite and 20% Due to paraquat poisoning.

Table-15 PREVALENCE OF COMPLICATIONS DURING HD

Sl.No	COMPLICATIONS	NO OF PATIENTS	PERCENTAGE
1	PRESENT	64	34%
2	ABSENT	126	66%

Figure -15 PREVALENCE OF COMPLICATIONS DURING HD



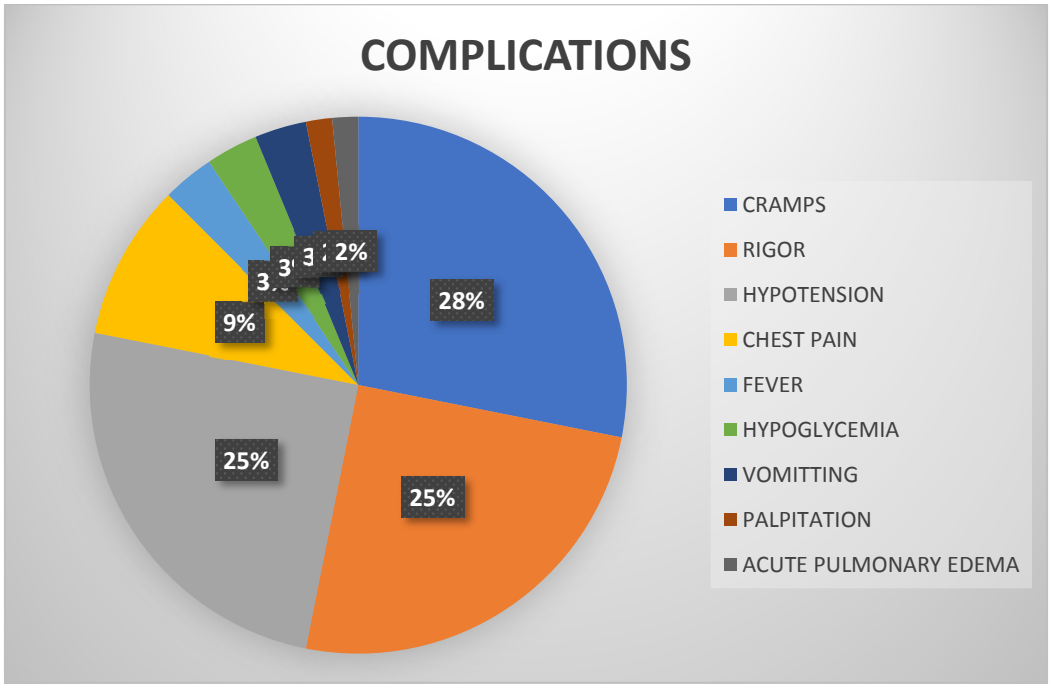
34% of the patients were recorded with complications during hemodialysis.

Table-16 PATTERN OF VARIOUS COMPLICATIONS ENCOUNTERED DURING HD

Sl.No	COMPLICATIONS(N=64)	NO OF PATIENTS	PERCENTAGE
1.	CRAMPS	18	28%
2.	HYPOTENSION	16	25%
3.	RIGOR	16	25%
4.	CHEST PAIN	6	9%
5.	FEVER	2	3%
6.	HYPOGLYCEMIA	2	3%
7.	VOMITING	2	3%
8.	PALPITATION	1	2%
9.	ACUTE PULMONARY EDEMA	1	2%

Among the complications 28 % were due to muscle cramping and 25% each due to hypotension and rigors

Figure -16 PATTERN OF VARIOUS COMPLICATIONS ENCOUNTERED DURING HD

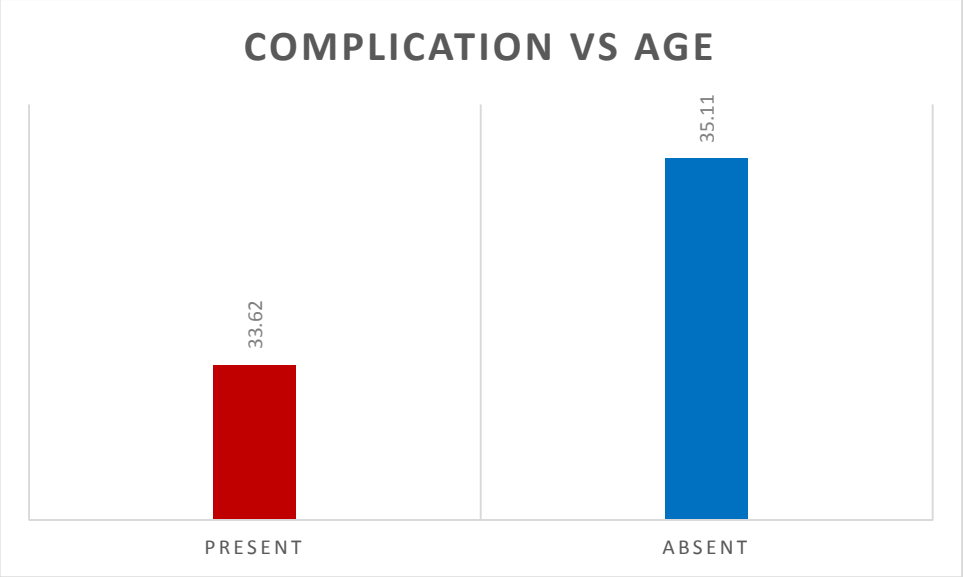


Various intradialytic complications of HD, 28% due to cramping and 25% due to hypotension and another 25% due to rigors. These are the most commonly encountered complications during intradialytic period.

Table-17 COMPLICATIONS VS AGE IN YEARS

COMPLICATIONS	AGE IN YEARS	
	MEAN	SD
PRESENT	33.62	12.05
ABSENT	35.11	11.12
UNPAIRED T TEST		
P VALUE - 0.411		
NON SIGNIFICANT		

Figure -17 COMPLICATIONS VS AGE IN YEARS

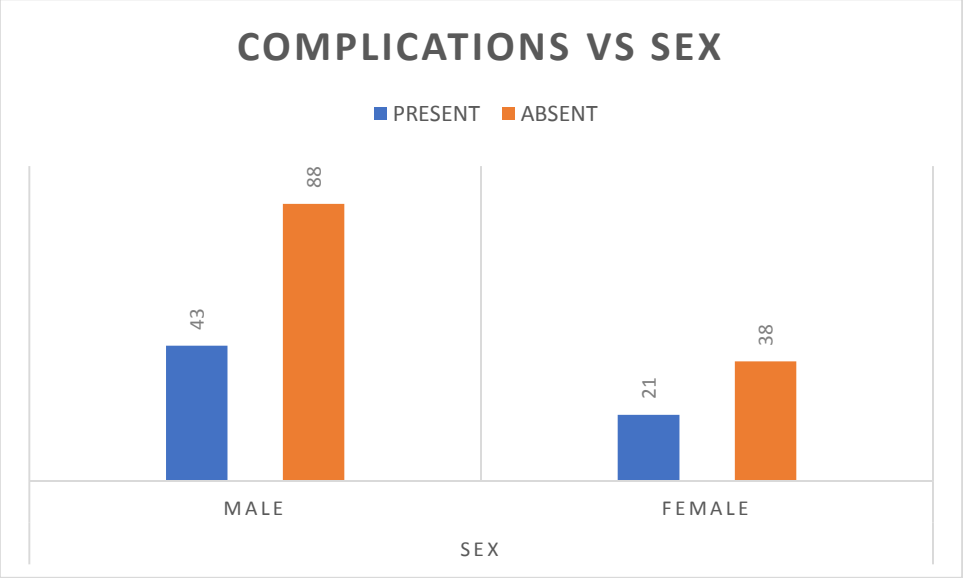


No significant relationship between age and intradialytic complications noted within our study, probably because more number of patients were between the age groups of 21 to 30 years

Table 18 COMPLICATIONS VS SEX

COMPLICATIONS	SEX	
	MALE	FEMALE
PRESENT	43(33%)	21(36%)
ABSENT	88(67%)	38(64%)
CHI SQUARE TEST		
P VALUE - 0.709		
NON SIGNIFICANT		

Figure 18 COMPLICATIONS VS SEX

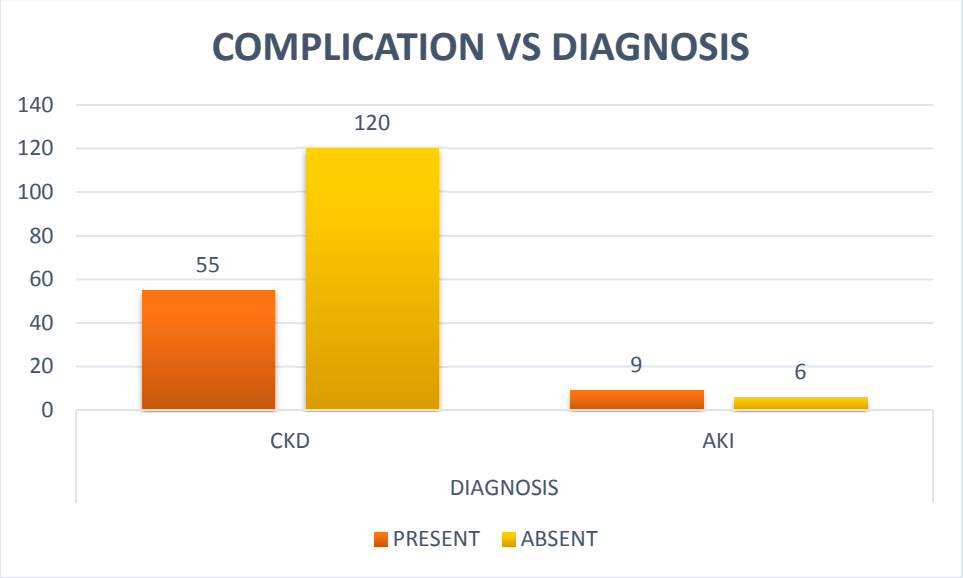


No significant relationship between gender and complication

Table-19 COMPLICATIONS VS DIAGNOSIS

COMPLICATIONS	DIAGNOSIS	
	CKD	AKI
PRESENT	55(31%)	9(60%)
ABSENT	120(69%)	6(40%)
CHI SQUARE TEST		
P VALUE - 0.025		
SIGNIFICANT		

Figure -19 COMPLICATIONS VS DIAGNOSIS



There is a significant relationship between intradialytic complications in patients with AKI (60%)

Table-20 COMPLICATIONS VS CATHETER

COMPLICATIONS	CATHETAR	
	PERMENANT	TEMPORARY
PRESENT	49(31%)	15(43%)
ABSENT	106(69%)	20(57%)
CHI SQUARE TEST		
P VALUE - 0.204		
NON SIGNIFICANT		

Figure -20 COMPLICATIONS VS CATHETER

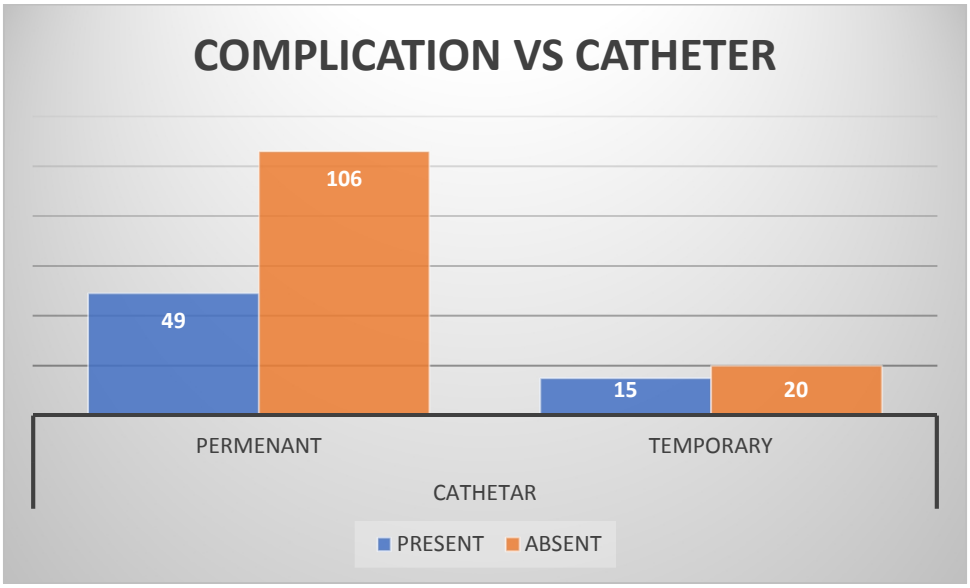


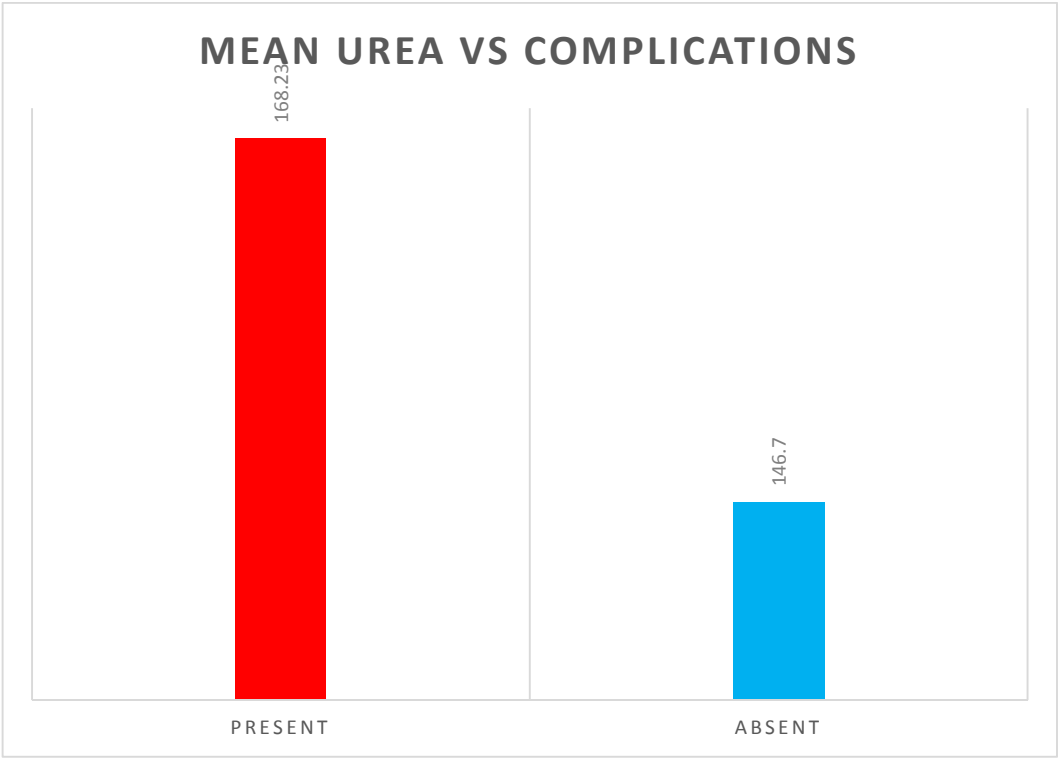
Figure-20

No significance noted with the type of catheter and intradialytic complication

Table-21 COMPLICATIONS VS BLOOD UREA

COMPLICATIONS	BLOOD UREA	
	MEAN	SD
PRESENT	168.23	55.32
ABSENT	146.7	51.97
UNPAIRED T TEST		
P VALUE - 0.024		
SIGNIFICANT		

Figure -21 COMPLICATIONS VS BLOOD UREA

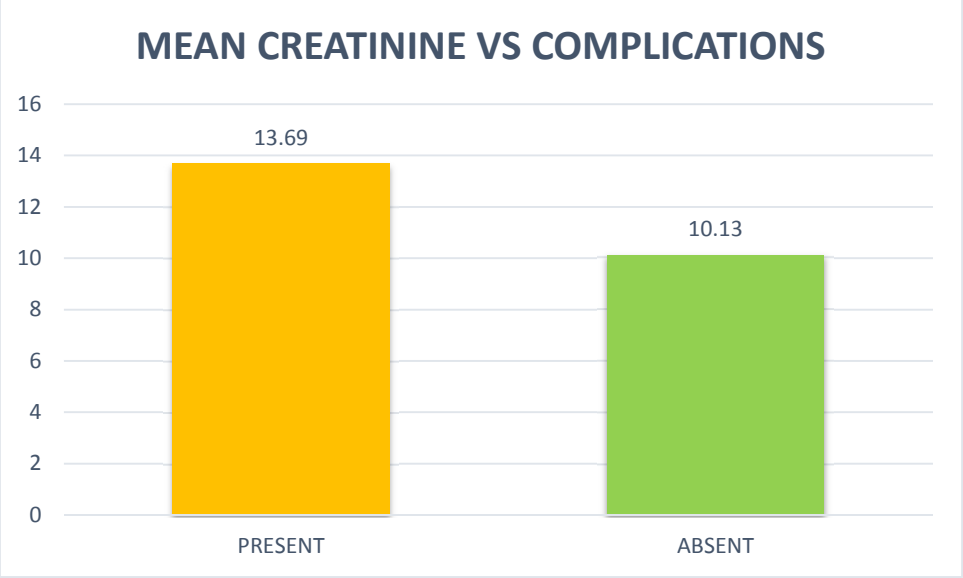


There is a significant statistical correlation between blood urea levels and intradialytic complications.

Table 22 COMPLICATIONS VS SERUM CREATININE

COMPLICATIONS	SERUM CREATININE	
	MEAN	SD
PRESENT	13.69	4.44
ABSENT	10.13	4.72
UNPAIRED T TEST		
P VALUE - 0.036		
SIGNIFICANT		

Figure 22 COMPLICATIONS VS SERUM CREATININE

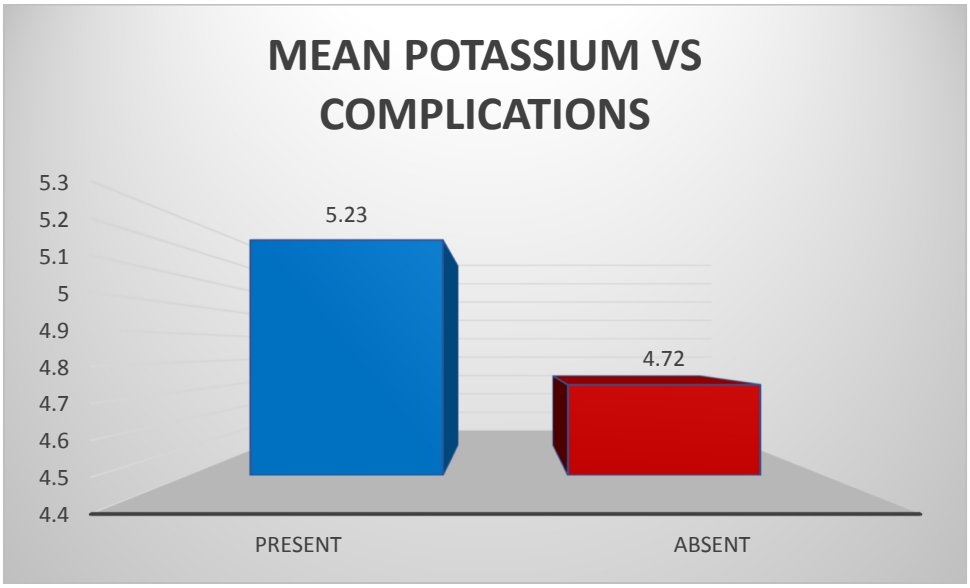


There is a noted statistical significance between serum creatinine levels and intradialytic complications.

Table – 23 COMPLICATION VS POTASSIUM LEVELS

COMPLICATIONS	POTASSIUM	
	MEAN	SD
PRESENT	5.23	0.73
ABSENT	4.72	0.77
UNPAIRED T TEST		
P VALUE - 0.05		
SIGNIFICANT		

Figure – 23 COMPLICATION VS POTASSIUM LEVELS

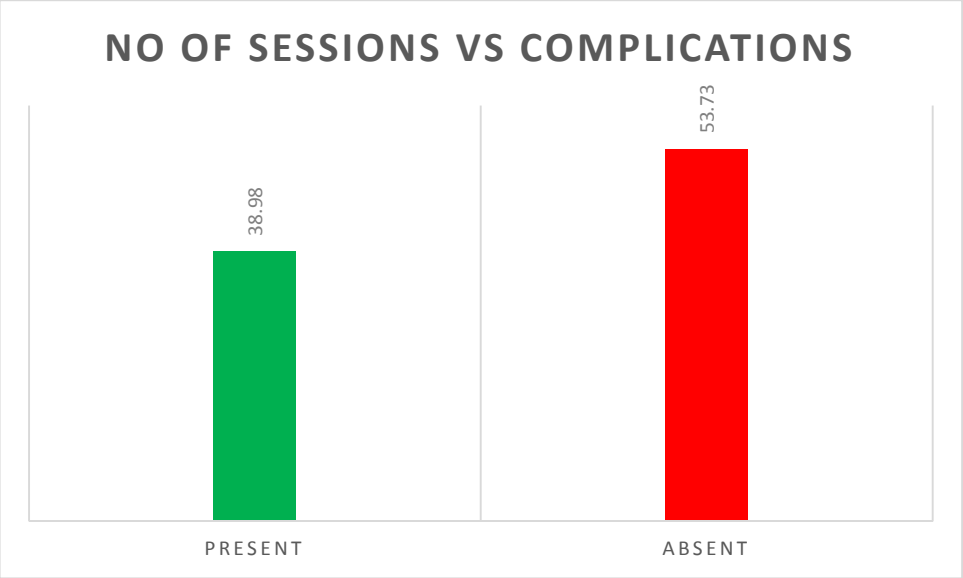


Statistical significance noted with Potassium levels and Intradialytic complications

Table-24 COMPLICATION VS NUMBER OF SESSIONS OF DIALYSIS

COMPLICATIONS	NO OF SESSIONS	
	MEAN	SD
PRESENT	38.98	48.67
ABSENT	53.73	65.01
UNPAIRED T TEST		
P VALUE - 0.111		
NON SIGNIFICANT		

Figure -24 COMPLICATION VS NUMBER OF SESSIONS OF DIALYSIS

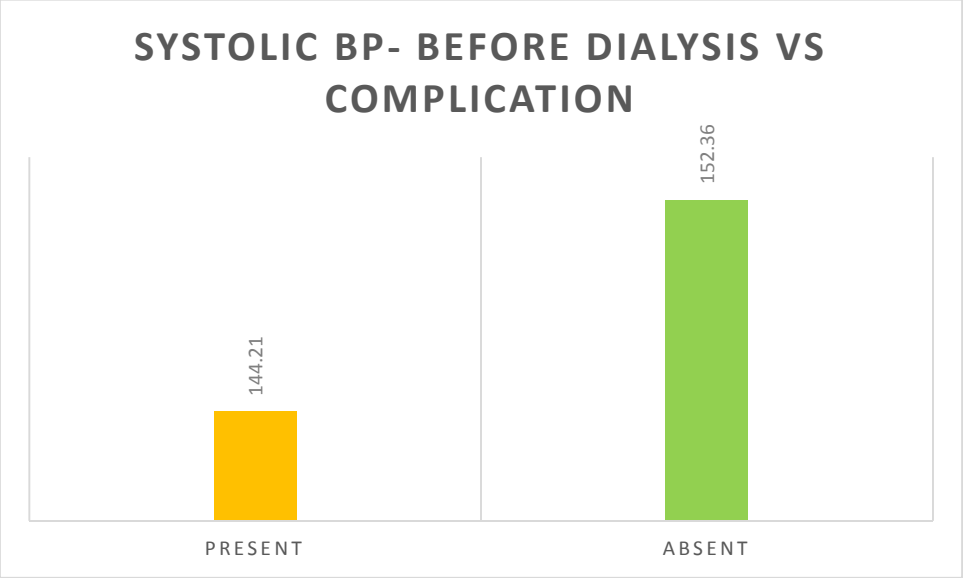


No significant correlation between number of sessions and intradialytic complications noted

Table-25 COMPLICATION VS SYSTOLIC BP BEFORE DIALYSIS

COMPLICATIONS	SYSTOLIC BP -BEFORE DIALYSIS	
	MEAN	SD
PRESENT	144.21	22.45
ABSENT	152.36	21.7
UNPAIRED T TEST		
P VALUE - 0.017		
SIGNIFICANT		

Figure -25 COMPLICATION VS SYSTOLIC BP BEFORE DIALYSIS

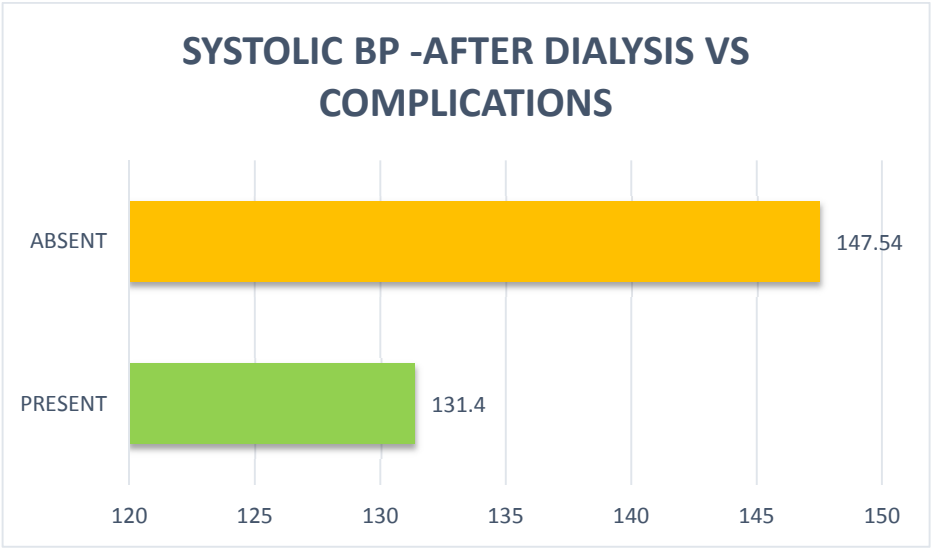


There is a significant relationship with complications and high systolic blood pressure before dialysis

Table-26 COMPLICATION VS SYSTOLIC BP AFTER DIALYSIS

COMPLICATIONS	SYSTOLIC BP - AFTER DIALYSIS	
	MEAN	SD
PRESENT	131.4	33.15
ABSENT	147.54	20.02
UNPAIRED T TEST		
P VALUE - 0.001		
SIGNIFICANT		

Figure -26 COMPLICATION VS SYSTOLIC BP AFTER DIALYSIS

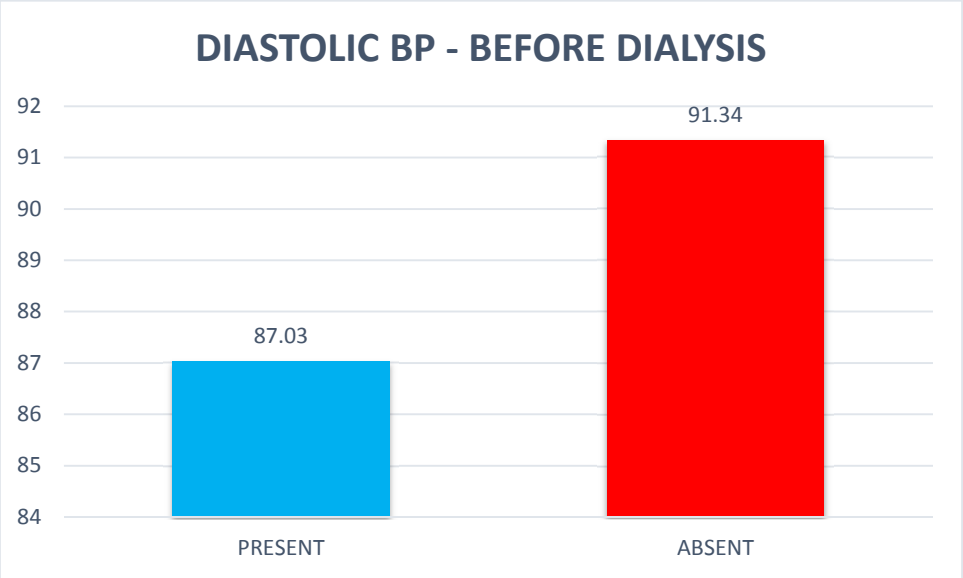


Statistical significance noted in systolic BP before and after hemodialysis versus complications

Table-27 COMPLICATION VS DIASTOLIC BP BEFORE DIALYSIS

COMPLICATIONS	DIASTOLIC BP -BEFORE DIALYSIS	
	MEAN	SD
PRESENT	87.03	10.18
ABSENT	91.34	9.91
UNPAIRED T TEST		
P VALUE - 0.001		
SIGNIFICANT		

Figure -27 COMPLICATION VS DIASTOLIC BP BEFORE DIALYSIS

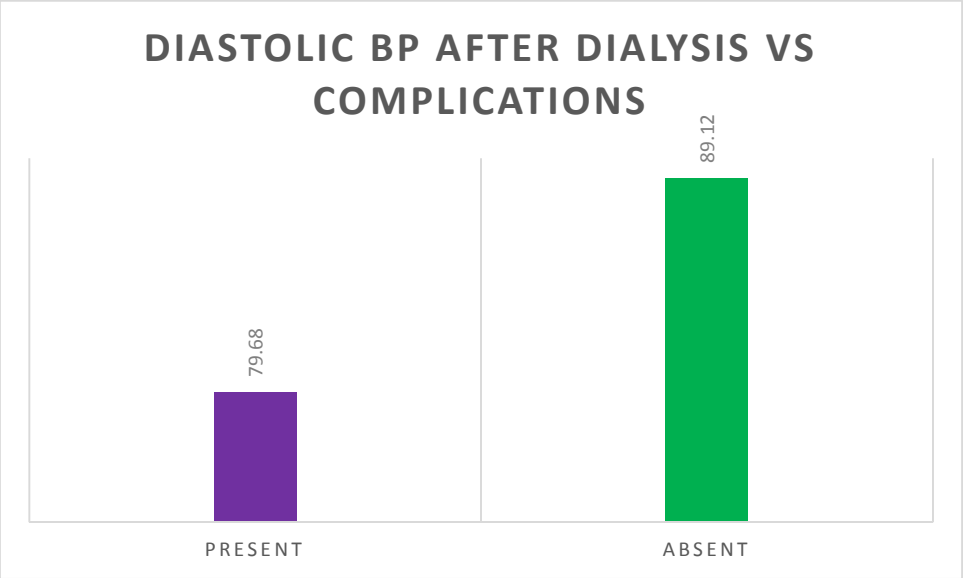


There is a significant relationship with diastolic blood pressure and complications

Table -28 COMPLICATION VS DIASTOLIC BP AFTER DIALYSIS

COMPLICATIONS	DIASTOLIC BP - AFTER DIALYSIS	
	MEAN	SD
PRESENT	79.68	18.08
ABSENT	89.12	9.12
UNPAIRED T TEST		
P VALUE - 0.001		
SIGNIFICANT		

Figure -28 COMPLICATION VS DIASTOLIC BP AFTER DIALYSIS



There is also a statistical significance with diastolic BP before and after versus intradialytic complications

Table-29 Patients with pre-existing Hypertension in our group:

S.No		Numbers	Percentage
1	Patients with HTN	163	86%
2	Patients without HTN	27	14%

In our study out of 190 patients 163 Patients were Hypertensives

Table-30 Patients with Pre-existing DM in our group:

S.No		Numbers	Percentage
1	Patients with DM	20	11%
2	Patients without DM	170	89%

In our study out of 190 patients 20 Patients were diabetic.

Table-31 AGE WISE DISTRIBUTION OF MUSCLE CRAMPING

Sl.No	Cramps	Males	Females
1	13-20 yrs	3	1
2	21-30 yrs	4	0
3	31-40 yrs	4	0
4	>40 Yrs	5	1

Cramping is a common complications associated with people undergoing HD of >40 years of Age Group ,among the 18 patients 16 were males and 2 were females,cramping occurs in 34% in patients with age more than 40 years.Cramping is common compication in both CKD and AKI patients.

Table-32 Age wise distribution of Hypotension

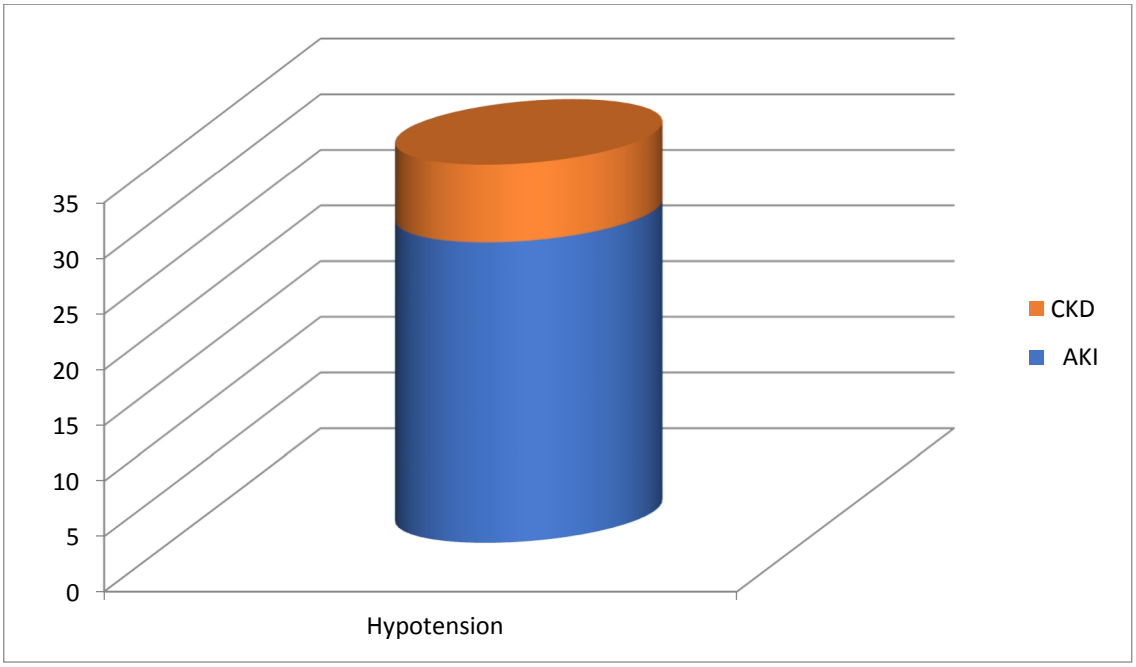
S.No	Hypotension	Males	Females
1	13-20 yrs	1	0
2	21-30 yrs	3	1
3	31-40 yrs	2	4
4	>40 Yrs	4	1

Hypotension is also a common complication in old age group people. In our study hypotension (25%) was the second most common complication encountered during the process of HD. 38% were between 31 to 40 years of age and 6% were 13 to 20 years of age group.

Table-33 Percentage of Hypotensive occurrence in AKI and CKD

Complication	AKI (15 patients)	CKD (175 patients)
Hypotension (16 patients)	4	12
Percentage	27%	7%

Figure-29 Percentage of Hypotensive occurrence in AKI and CKD



Among the 15 AKI patients 4(27%) developed hypotension compared to CKD 12(7%)

DISCUSSION:

Intradialytic complications are the major issues in patients with both AKI and CKD, who get into the hemodialysis routine as a part of their treatment.In our study the number of patients are more between the age group of 31 and 40 years. Gender wise analysis showed male preponderance(M:F 2.2:1) Hypotension (50%) is stated as the most common complication of hemodialysis [21]. More number of patients in our group who underwent hemodialysis had a prior diagnosis of CKD (92%).

In our study, out of 190 patients 64 (34%) developed complications. Among the 15 AKI patients, 9 (60%) developed complications compared with 31.4%. in CKD patients. In the study by Prabakar et al [22] hypotension was the most common complication with HD patients (20 to 50%). In another study by Mehimood et al [23] 37.5% developed hypotension and 12.5% patients developed cramps. In our study, 18 patients (28%) developed cramps and 25% patients got hypotension as an intradialytic complication. These 2 complications were the main complication in our study in AKI and CKD patients. There is no significant age and sex distribution relation in our study.There is no significant relationship between HCV infection with complications.

Muscle cramps in 18 patients (28%) being the commonest complication in our group might be due to excessive ultrafiltration and low dialysate sodium percentage. The next common problem in our group of patients were hypotension in 16 patients (25%) and rigors in 16 patients (25%). Hypotension could be probably due to high dialysate temperature, anti-hypertensive medication, high ultra-filtrate rate, autonomic dysfunction and low dialysate sodium.

There is a significant relationship with hypertension and no significant relationship with diabetes in our study. Other complications developed during the intradialytic period are chest pain(9%), fever(3%), hypoglycaemia(3%), vomiting(3%), palpitations(2%) and acute pulmonary edema (2%).

Complications such as Haemorrhage, hemolysis and arrhythmias did not occur on our study group of HD patients.

SUMMARY

- Among 190 patients with renal failure who underwent hemodialysis, they were selected strictly under inclusion criteria the following were observed.
    1. Males (69%) developed more complications than females (31%).
    2. Among 190 patients 92% were CKD patients and 8% had AKI.
    3. Among 190 patients 64 (34%) developed intradialytic complications.
    4. Patients with less than 50 sessions developed more complications
    5. Complications were more with AKI patients. Snake bite was the common cause of AKI in our study.
    6. Cramps and hypotension were the most common complications in our study.
    7. No relation with Hepatitis C infection and complication.

CONCLUSION

Hemodialysis is a better procedure for removal of toxic metabolic end products from systems in renal failure patients, but associated with risks with this 4 hour procedure. Thorough monitoring with each of the patient who underwent hemodialysis, 34% patients developed intradialytic complications and I am with this inference that, muscle cramps(28%), hypotension (25%) and rigors (25%) occur commonly and necessary precautionary measures has to be kept in line, if in case an emergency occur. Chest pain (9%) , Fever(3%) , hypoglycaemia (3%), vomiting(3%) , palpitations (2%) and acute pulmonary oedema(2%) should also be sought in mind to execute and emergency plan of action. In our study no significant relationship between age and sex distribution with complications.

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PROFORMA

Name :

Age/Sex :

Address :

Diagnosis : AKI/ CKD

Nature of the catheter : Permanent / Temporary

Number of Sessions:

Haemodialysis :

Starting Time

Ending Time

HCV : Positive / Negative

Symptoms:

Hypotension Yes / No

Nausea Yes / No

Vomiting Yes / No

Headache Yes / No

Fever Yes / No

Chills Yes / No

Muscle Cramps Yes / No

Chest Pain Yes / No

Itching Yes / No

Past History

- Diabetes Mellitus
- Hypertension

Family History

- Positive / Negative

Investigations

- Blood Sugar
- Renal Function Test
  - Blood Urea
  - Serum Creatinine
- Serum Electrolytes
  - Sodium
  - Potassium

ECG and X ray Chest (if Needed)

நோயாளிகளுக்கு அறிவிப்பு மற்றும் ஒப்புதல் படிவம்
(மருத்துவ ஆய்வில் பங்கேற்பதற்கு)

ஆய்வு செய்யப்படும் தலைப்பு:
பங்கு பெறுவரின் பெயர்:
பங்கு பெறுவரின் வயது:

		பங்கு பெறுவர் இதனை ✓ குறிக்கவும்
1.	நான் மேலே குறிப்பிட்டுள்ள மருத்துவ ஆய்வின் விவரங்களை படித்து புரிந்து கொண்டேன். என்னுடைய சந்தேகங்களை கேட்கவும், அதற்கான தகுந்த விளக்கங்களை பெறவும் வாய்ப்பளிக்கப்பட்டுள்ளது என அறிந்து கொண்டேன்.	☐
2.	நான் இவ்வாய்வில் தன்னிச்சையாக தான் பங்கேற்கிறேன். எந்த காரணத்தினாலோ எந்த கட்டத்திலும், எந்த சட்ட சிக்கலுக்கும் உட்படாமல் நான் இவ்வாய்வில் இருந்து விலகி கொள்ளலாம் என்றும் அறிந்து கொண்டேன்.	☐
3.	இந்த ஆய்வு சம்பந்தமாகவோ, இதை சார்ந்து மேலும் ஆய்வு மேற்காள்ளும் போதும் இந்த ஆய்வில் பங்குபெறும் மருத்துவர் என்னுடைய மருத்துவ அறிக்கைகளை பார்ப்பதற்கு என் அனுமதி தேவையில்லை என அறிந்து கொள்கிறேன். நான் ஆய்வில் இருந்து விலகிக் கொண்டாலும் இது பொருந்தும் என அறிகிறேன்.	☐
4.	இந்த ஆய்வின் மூலம் கிடைக்கும் தகவலையோ, முடிவையோ பயன்படுத்திக் கொள்ள மறுக்க மாட்டேன்.	☐
5.	இந்த ஆய்வில் பங்கு கொள்ள ஒப்புக் கொள்கிறேன் எனக்கு கொடுக்கப்பட்டஅறிவுரைகளின் படி நடந்து கொள்வதுடன், ஆய்வை மேற்கொள்ளும் மருத்துவ அணிக்கு உண்மையுடன் இருப்பேன் என்று உறுதியளிக்கிறேன். என் உடல் நலம் பாதிக்கப்பட்டாலோ, அல்லது எதிர்பாராத, வழக்கத்திற்கு மாறான நோய்குறி தென்பட்டாலோ உடனே இதை மருத்துவ அணியிடம் தெரிவிப்பேன் என உறுதி அளிக்றேன்.	☐

பங்கேற்பவரின் கையொப்பம் / ..... இடம் .....
கட்டைவிரல் ரேகை
பங்கேற்பவரின் பெயர் மற்றும் விலாசம் .....
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சாட்சியின் கையொப்பம் /..... இடம் .....
பெயர் மற்றும் விலாசம் ....

S.no	Age	Gender		Diagnosis	Catheter		HHH	Urea	Creatinine	Na	K	No of Sessions	DM	HTN	BLOOD PRESSURE		Cause	INTRADILAYTIC COMPLICATIONS
		M	F		PERMANENT	TEMPORARY									Before DIALYSIS	After DIALYSIS		
1	38	1		ckd	1		neg	183	13.7	140	4.6	9		1	160/100	**90/70**		**Hypotension**
2	37		1	ckd	1		neg	111	9.1	136	5.3	18		1	140/100	140/90		**nil**
3	38	1		ckd	1		neg	148	12.4	150	5.8	24		1	190/100	180/90		**rigor**
4	25	1		ckd	1		neg	230	9.7	128	5.1	40		1	180/100	140/80		**nil**
5	32		1	ckd	1		neg	98	13.8	136	4.9	50		1	150/100	150/100		**nil**
6	41	1		ckd		1	neg	124	11.1	142	5.8	4	1	1	190/100	100/60		**hypotension**
7	30		1	ckd	1		neg	88	9	145	4.2	23		1	160/100	180/90		**nil**
8	20	1		ckd	1		neg	180	13.6	128	4	17		1	150/90	140/80		**cramps**
9	57	1		ckd	1		neg	103	11	140	5.4	12	1	1	160/100	180/90		**nil**
10	26	1		aki		1	neg	260	8.9	136	4.9	1		1	140/90	130/90	**RPGN**	**cramps**
11	50	1		ckd	1		neg	144	9.3	143	5.3	16	1	1	190/100	180/90		**nil**
12	31		1	ckd		1	neg	196	12	140	6.3	4		1	140/90	150/90		**chest pain**
13	25		1	ckd	1		neg	120	9	137	5.4	36		1	150/90	100/70		**nil**
14	56	1		ckd	1		neg	189	13.2	152	5.2	65	1	1	190/100	190/100		**nil**
15	37	1		ckd	1		neg	148	10.7	130	6	47		1	150/100	140/90		**nil**
16	36		1	ckd	1		neg	120	9.7	152	5.2	23		1	140/90	140/90		**nil**
17	31		1	ckd	1		neg	189	14.6	142	5.5	43		1	150/90	160/90		**hypoglycemia**
18	40		1	ckd	1		neg	140	9.8	129	4.4	22		1	160/100	110/80		**rigors**
19	37	1		ckd	1		neg	112	9.2	137	5.9	27		1	140/90	150/100		**nil**
20	48	1		ckd	1		neg	120	9.8	138	5	29	1	1	150/100	140/90		**nil**
21	39	1		ckd	1		neg	130	11	132	4.2	38		1	150/90	110/80		**rigors**
22	25		1	ckd		1	neg	128	14	145	5.8	4		1	190/100	180/90		**nil**
23	29	1		ckd		1	neg	141	10.4	136	4.6	1		1	140/100	100/70		**cramps**
24	31	1		ckd	1		neg	198	12.1	123	4.2	15		1	180/90	160/90		**nil**
25	50		1	ckd	1		neg	92	11	141	5.8	19	1	1	150/100	150/100		**nil**
26	31		1	ckd	1		neg	68	9.6	132	5	18		1	120/90	**90/60**		**hypotension**
27	37		1	ckd		1	neg	168	11	152	4.6	2		1	140/90	140/80		**nil**
28	22	1		ckd	1		neg	300	18.2	127	4.9	45		1	150/100	140/90		**nil**
29	45		1	aki		1	neg	260	10.2	138	5.9	2	1	1	180/90	160/90	**RPGN**	**nil**
30	25	1		ckd	1		neg	194	12.6	138	5	50		1	150/100	140/90		**nil**
31	31	1		ckd	1		neg	226	26	128	3.6	23		1	180/100	180/90		**cramps**

32	30	1		ckd	1		neg	141	8.8	139	4.8	13		1	140/90	140/80		**nil**
33	47	1		ckd	1		neg	98	9.4	140	4	49	1	1	120/90	120/80		**nil**
34	16	1		ckd		1	neg	146	9.8	140	5	2		1	140/90	130/80		**nil**
35	18	1		ckd	1		neg	230	12.1	120	4	19		1	180/100	170/90		**nil**
36	25		1	ckd		1	neg	121	10.2	143	4.2	3		1	130/90	140/90		**nil**
37	43	1		ckd	1		neg	112	11.6	128	4.5	26		1	140/90	**90/60**		**hypotension**
38	25		1	ckd	1		neg	180	16	142	5.4	31		1	200/100	190/100		**nil**
39	30		1	ckd	1		neg	160	12.6	143	4	18		1	140/100	140/90		**nil**
40	34	1		ckd	1		neg	145	9	145	4.4	41		1	180/90	180/90		**cramps**
41	34	1		ckd	1		neg	300	33.6	156	6	45	1		120/80	120/80		**nil**
42	22	1		ckd	1		neg	149	14.9	132	3.1	23		1	150/100	140/90		**nil**
43	48	1		ckd	1		neg	240	20	145	4.2	18	1	1	190/100	140/90		**nil**
44	17		1	ckd	1		neg	160	9.4	128	6.2	8		1	160/90	160/80		**nil**
45	36		1	ckd	1		neg	98	8.9	140	5.7	43		1	120/90	120/80		**rigor**
46	30	1		ckd		1	neg	121	12.6	138	4	4		1	130/90	140/90		**nil**
47	24	1		ckd	1		neg	200	21	135	5.4	36		1	140/90	150/90		**nil**
48	37	1		ckd	1		neg	168	16	121	4.1	21		1	180/100	180/100		**chest pain**
49	22		1	ckd		1	neg			140	4.2	2		1	140/90	140/90		**nil**
50	21	1		aki		1	neg	260	9.6	145	5.6	2		1	140/90	140/90	**snake bite**	**nil**
51	25	1		ckd		1	neg	145	11	150	4.6	3			100/70	100/70		**nil**
52	25		1	ckd	1		neg	96	9.3	142	4.7	30		1	180/100	160/100		**rigor**
53	44	1		ckd	1		neg	154	12.6	120	4	24	1	1	160/100	140/90		**nil**
54	19		1	ckd	1		neg	142	14.1	136	5	24		1	120/90	130/80		**nil**
55	62	1		ckd	1		neg	300	33.4	140	6	25	1	1	190/100	180/90		**cramps**
56	57	1		ckd	1		neg	160	12	150	5.4	12		1	130/90	100/80		**nil**
57	20	1		ckd	1		neg	102	12.6	143	5.2	18		1	150/90	140/70		**nil**
58	50	1		ckd	1		neg	164	9.6	136	4.8	41		1	170/90	150/90		**chest pain**
59	38	1		ckd		1	neg	188	12.1	128	5.4	8		1	160/90	160/100		**nil**
60	18	1		ckd	1		neg	144	8.6	135	4.9	24		1	140/90	120/80		**nil**
61	26	1		aki		1	neg	260	9	142	5.4	1		1	140/90	130/90	**snake bite**	**cramps**
62	25		1	ckd		1	neg	152	14.3	140	4.6	2			130/80	**90/40**		**hypotension**
63	34	1		ckd	1		neg	98	11.1	136	5	39			120/80	110/80		**nil**
64	43	1		ckd	1		neg	106	12.6	132	6.4	30		1	180/100	170/90		**nil**
65	30		1	ckd	1		neg	207	13.4	148	3	18		1	140/90	120/90		**nil**
66	34	1		ckd	1		neg	220	17.8	141	5	37		1	160/90	150/100		**fever**
67	24	1		ckd	1		neg	160	14.1	140	4.6	20		1	160/100	150/90		**nil**

68	36		1	ckd	1		neg	145	9.8	139	4.2	9		1	140/100	140/90		**nil**
69	31		1	ckd	1		neg	126	10.6	127	4.1	8		1	150/100	150/100		**rigors**
70	22		1	ckd		1	neg	107	15.7	136	3.8	3		1	160/100	160/90		**vomiting**
71	37	1		ckd	1		neg	139	20.2	137	4.2	11		1	160/100	150/90		**nil**
72	18	1		ckd	1		neg	125	12.7	141	4.5	14		1	150/90	120/80		**cramps**
73	36	1		ckd		1	neg	211	18.6	140	6	3		1	160/90	150/90		**nil**
74	25	1		ckd		1	neg	160	17.2	128	4	4		1	150/90	140/90		**hypoglycemia**
75	62	1		ckd	1		neg	141	15.7	142	4.6	46	1	1	180/100	190/80		**nil**
76	37		1	ckd	1		neg	120	10.6	138	4.5	43		1	130/90	130/90		**nil**
77	36		1	ckd	1		neg	196	14.6	130	5	41		1	130/100	**90/40**		**hypotension**
78	37	1		ckd	1		neg	140	7.8	140	6.2	23		1	160/90	150/100		**nil**
79	58	1		aki		1	neg	236	20.6	146	5.6	2		1	130/90	140/90	**B/L HUN**	**nil**
80	48	1		Ckd	1		neg	120	9.6	142	4.2	24		1	160/90	150/90		**nil**
81	33	1		Ckd	1		neg	152	14.2	138	4.5	26		1	180/90	160/100		**nil**
82	32	1		ckd	1		neg	103	11	125	3	89		1	140/90	120/80		**rigor**
83	39	1		ckd	1		neg	156	14	152	4.6	56	1	1	160/90	150/80		**nil**
84	29	1		ckd	1		neg	165	11.2	136	4.1	106		1	130/90	140/90		**cramps**
85	25	1		ckd	1		neg	146	12.1	142	3.8	67		1	140/90	140/90		**nil**
86	36		1	ckd	1		neg	189	14.2	140	3.7	27		1	130/90	**80/50**		**hypotension**
87	34	1		ckd	1		neg	98	9	141	4.5	16		1	140/90	120/80		**nil**
88	36	1		ckd	1		neg	268	27	145	6.4	26		1	160/90	150/90		**nil**
89	28	1		ckd	1		neg	144	14.6	142	4.1	103		1	140/90	140/90		**cramps**
90	31		1	ckd	1		neg	156	12.2	144	4.2	230		1	160/100	150/90		**nil**
91	18	1		ckd	1		neg	126	12	142	4.2	36		1	150/90	140/80		**rigor**
92	25		1	ckd	1		neg	101	9.7	127	5	96		1	150/100	150/100		**nil**
93	40	1		aki		1	neg	286	26.7	126	5.7	2	1		100/70	**80/50**	**Acute pancreatitis with AKI**	**hypotension**
94	32		1	ckd	1		neg	90	12.3	132	5.2	45		1	200/100	180/90		**nil**
95	42	1		ckd	1		neg	200	22.6	143	6.4	95		1	180/100	180/90		**nil**
96	34	1		ckd	1		neg	186	14.6	146	4.9	236		1	160/90	150/100		**cramps**
97	22	1		ckd	1		neg	147	16.2	130	4.9	42		1	130/90	120/80		**nil**
98	17		1	ckd		1	neg	159	12.7	142	5.6	4			100/70	100/80		**vomiting**
99	24	1		ckd	1		neg	212	30	140	7.1	87		1	130/90	140/80		**nil**
100	18	1		ckd	1		neg	178	12.1	138	5	47		1	140/90	150/100		**rigor**

101	62	1		ckd	1		neg	190	17.6	151	5.4	41	1	1	180/100	160/90		**nil**
102	19		1	ckd	1		neg	106	14.5	140	5.6	7		1	140/100	150/90		**cramps**
103	44	1		ckd	1		neg	96	9	138	4.7	78		1	160/90	140/80		**nil**
104	39		1	ckd	1		neg	236	13.6	139	4.1	18			120/80	**80/40**		**hypotension**
105	37	1		ckd	1		neg	178	17	142	5.7	27			120/80	110/80		**nil**
106	32	1		ckd	1		neg	89	20.1	125	4.8	326		1	160/100	160/90		**nil**
107	50		1	ckd	1		neg	122	16.9	153	6	56		1	170/100	180/100		**rigor**
108	39		1	ckd	1		neg	112	17.1	138	6.4	79			170/80	170/90		**nil**
109	29	1		ckd	1		neg	80	16.3	148	5.2	88			160/80	160/100		**fever**
110	50		1	ckd	1		neg	125	13.6	149	4.4	18	1	1	180/110	170/100		**nil**
111	28	1		ckd	1		neg	178	17.6	138	4.1	205		1	190/100	180/90		**rigors**
112	25		1	ckd	1		neg	163	14.2	152	5.7	72		1	170/100	170/100		**nil**
113	38	1		ckd	1		neg	98	10.7	135	3.9	12		1	160/90	**70/40**		**hypotension**
114	38	1		ckd	1		neg	302	27.8	146	5.6	7	1	1	160/110	170/110		**nil**
115	38	1		ckd	1		neg	148	14.2	144	4.9	72		1	150/90	140/90		**nil**
116	31		1	ckd	1		neg	139	12.4	140	4.1	27		1	150/100	150/90		**chest pain**
117	32		1	ckd		1	neg	198	18.7	138	4.8	6			120/80	120/80		**nil**
118	47	1		ckd	1		neg	104	12.7	140	5.8	78		1	148/90	150/90		**nil**
119	35	1		aki	1		neg	296	12.2	146	5.6	3			140/80	140/90	**snake bite**	**cramps**
120	18	1		aki	1		neg	246	14.4	142	5.4	1		1	130/90	130/80	**paraquat**	**cramps**
121	19	1		ckd	1		neg	98	9.7	160	5.2	78			130/60	140/70		**nil**
122	44	1		ckd	1		neg	121	12.7	141	4.7	104		1	150/100	150/90		**nil**
123	40	1		ckd	1		neg	138	13.9	147	5.3	52		1	160/90	**90/60**		**hypotension**
124	39	1		ckd	1		neg	140	12	141	4.2	16		1	180/100	180/90		**nil**
125	32		1	ckd	1		neg	173	19.7	149	4.3	45		1	150/100	140/100		**nil**
126	47	1		ckd	1		neg	127	14.8	128	3.2	12			130/80	140/90		**nil**
127	50	1		ckd	1		neg	147	15.2	140	5.2	32			130/70	120/70		**palpitations**
128	57	1		ckd		1	neg	170	17.3	142	4.8	4		1	200/100	190/110		**nil**
129	38	1		ckd	1		neg	180	16.9	138	4	78		1	160/90	140/80		**nil**
130	61	1		aki		1	neg	252	18.6	145	5.6	2		1	140/90	150/80	**Obstructive uropathy**	**cramps**
131	20	1		ckd	1		neg	139	20.2	143	5.4	167		1	200/120	160/80		**nil**
132	50	1		ckd	1		neg	138	16.3	140	4.2	92		1	150/100	150/90		**nil**

133	32		1	ckd	1		neg	148	12.7	142	4.1	230		1	160/110	170/100		**nil**
134	42	1		ckd	1		neg	220	20.7	148	4.5	78		1	150/100	150/90		**nil**
135	31		1	Ckd	1		neg	188	16.8	141	5.8	106			120/80	120/80		**nil**
136	34	1		ckd	1		neg	104	10.7	137	4.5	92		1	160/90	150/100		**nil**
137	34	1		ckd		1	neg	98	9.2	130	4.4	4		1	140/90	**70/50**		**hypotension**
138	22		1	ckd	1		neg	188	16.7	132	4.2	27			140/80	130/90		**nil**
139	17		1	ckd	1		neg	141	14.2	148	6	186		1	160/90	140/80		**nil**
140	48	1		ckd	1		neg	138	15.1	141	4.8	111			150/80	140/70		**cramps**
141	37	1		ckd	1		neg	201	18.2	142	3.8	27		1	160/100	150/90		**nil**
142	24	1		ckd	1		neg	188	12.7	143	3.5	11			130/80	170/120		**nil**
143	45		1	aki/cellulitis		1	neg	280	22.6	148	6.2	3		1	150/90	140/100	**snake bite**	**nil**
144	36	1		ckd	1		neg	186	16.4	142	4.8	230		1	160/90	160/100		**nil**
145	25		1	ckd		1	neg	156	14.4	147	4.4	4			140/80	140/90		**nil**
146	62	1		ckd	1		neg	148	12.7	144	5.1	12			160/70	150/80		**nil**
147	44	1		ckd	1		neg	203	18.7	138	4.3	203		1	160/90	160/80		**nil**
148	40	1		ckd	1		neg	166	13.2	141	4.1	42			140/80	140/90		**nil**
149	26	1		aki		1	neg	146	9.6	140	4.4	1		1	140/90	90/60	**Paraquat poisoning**	**hypotension**
150	39		1	ckd	1		neg	189	17.6	150	3.8	96		1	130/90	140/90		**nil**
151	19		1	ckd		1	neg	100	12.3	130	4.8	6		1	140/90	140/90		**nil**
152	37	1		ckd	1		neg	162	18	142	4	46		1	120/90	160/90		**nil**
153	36		1	ckd	1		neg	230	18.2	148	5.4	205		1	170/100	170/100		**nil**
154	34	1		ckd	1		neg	152	12.6	140	4.1	47		1	200/100	190/100		**nil**
155	22	1		aki		1	neg	230	12.6	142	4.7	2		1	140/100	140/90	**snake bite**	**rigors**
156	48	1		ckd	1		neg	146	11.7	128	4.2	94		1	150/100	140/90		**nil**
157	39	1		ckd	1		neg	158	14.2	143	5	41		1	180/100	170/100		**nil**
158	59	1		ckd	1		neg	90	9.8	145	4.8	232		1	140/90	140/80		**nil**
159	59	1		ckd	1		neg	152	13.2	140	5.2	23		1	160/90	160/90		**nil**
160	25		1	ckd	1		neg	140	11.1	141	4.4	11			120/80	90/50		**hypotension**
161	48	1		ckd	1		Neg	75	9.4	138	5.6	121		1	150/90	120/80		**nil**
162	36	1		ckd	1		neg	113	10.8	141	5.4	125		1	160/90	180/100		**nil**
163	28	1		ckd	1		neg	60	10	139	5.5	100		1	200/110	170/110		**nil**
164	18		1	ckd	1		neg	87	15.3	141	5.8	90		1	150/90	180/100		**rigor**
165	27	1		ckd	1		neg	118	17.6	141	6	138			150/70	160/100		**chest pain**

166	32	1		ckd	1		neg	93	13.3	141	5.6	56		1	160/90	160/90		**nil**
167	48		1	ckd	1		neg	64	8.2	148	5.9	168			140/80	190/100		**Ac Pul Oedema**
168	21		1	ckd	1		neg	87	9.3	138	5.6	42		1	150/90	140/100		**nil**
169	36	1		ckd	1		neg	230	16.7	130	6.2	169		1	180/100	180/100		**nil**
170	25	1		aki		1	neg	68	6	148	5.2	1			120/80	130/80	**Snake bite**	**nil**
171	32	1		ckd	1		neg	187	12.1	130	5.4	2		1	150/100	140/100		**nil**
172	26	1		ckd	1		HCV	89	10.3	140	5.5	362		1	160/100	100/60		**nil**
173	28	1		ckd	1		neg	172	19.7	130	4.4	8		1	130/90	140/90		**nil**
174	68	1		ckd	1		neg	121	14.9	132	4.9	13	1	1	150/90	**90/60**		**Hypotension**
175	37	1		ckd	1		neg	140	15.7	140	4.6	16		1	140/90	140/80		**nil**
176	26		1	ckd	1		neg	160	17.2	140	4.6	23		1	150/90	150/80		**nil**
177	25	1		aki		1	neg	86	7.2	132	4.2	1			130/80	120/80	**Paraquat poisoning**	**nil**
178	33	1		ckd	1		neg	166	16	142	4.8	23		1	150/90	140/80		**Chest pain**
179	28		1	ckd	1		neg	172	16.6	142	4.8	62		1	150/90	130/90		**nil**
180	23	1		ckd	1		neg	125	12.5	144	4.7	23		1	150/100	150/90		**rigor**
181	17	1		ckd	1		neg	125	10	147	4.3	85		1	140/90	80/50		**Hypotension**
182	29		1	ckd	1		neg	139	20.2	142	4.3	32		1	160/80	150/100		**Cramps**
183	48	1		ckd		1	neg	230	26	120	6	5		1	160/100	150/100		**nil**
184	53		1	ckd	1		neg	133	16.3	142	4.6	52		1	160/100	150/90		**Cramps**
185	27	1		ckd	1		neg	107	15.7	137	4.6	56		1	160/100	150/80		**nil**
186	38	1		ckd	1		neg	122	14.3	150	5.2	102		1	160/80	150/100		**nil**
187	67	1		ckd	1		neg	158	9.6	149	6	46	1	1	150/80	130/90		**rigor**
188	28	1		aki		1	neg	96	10	146	5.6	2		1	120/90	130/80	**T2DM /HUN**	**rigor**
189	34	1		Ckd	1		HCV	260	13.4	140	4.2	66		1	150/90	140/80		**nil**
190	39	1		Ckd	1		HCV	189	14.3	142	3.8	49		1	140/90	130/80		**nil**